ROHDE&SCHWARZ

MP MASTER
MA20655

ROHDE&SCHWARZ
Test and Measurement
Division

Service Manual Instrument

SPECTRUM ANALYZER

R&S® FSU3
1166.1660.03

R&S® FSU8
1166.1660.08

R&S® FSU26
1166.1660.26

R&S® FSU46
1166.1660.46

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Republic of Germany

Dear Customer,

throughout this operating manual, the abbreviation FSU is used for your Spectrum Analyzer R&S FSU.

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Service and Repair

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Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

Safety-related symbols used on equipment and documentation from R&S:

Observe operating instructions

Weight indication for units >18 kg

PE terminal

Ground terminal

Danger! Shock hazard

Warning! Hot surfaces

Ground

Attention! Electrostatic sensitive devices require special care

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   IP degree of protection 2X, pollution severity 2 overvoltage category 2, only for indoor use, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

   Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made. Installation and cabling of the unit to be performed only by qualified technical personnel.

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

continued overleaf

10. Ensure that the connections with information technology equipment comply with IEC950 / EN60950.
11. Lithium batteries must not be exposed to high temperatures or fire.

    Keep batteries away from children.

    If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see spare part list).

    Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.

    Do not short-circuit the battery.
12. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic and mechanical protection.
13. Electrostatics via the connectors may damage the equipment. For the safe handling and operation of the equipment, appropriate measures against electrostatics should be implemented.
14. The outside of the instrument is suitably cleaned using a soft, lint-free dustcloth. Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.
15. Any additional safety instructions given in this manual are also to be observed.

Safety Instructions

The instrument contains components which are hazardous to electrostatic exposure and which are marked by the following symbol:

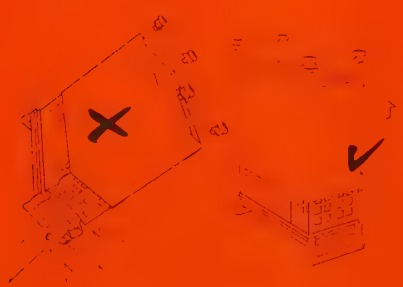
- To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).

The following two methods of ESD protection may be used together or separately:

- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

The batteries used in the instrument are high-power lithium cells with a life utility of approx. 5 years. If you do not handle them properly, there is a danger of explosion. Therefore, observe the following safety instructions:

- Avoid short-circuit and loading of the battery
- Do not expose lithium batteries to high temperature or fire.
- Do not open used batteries
- Keep batteries away from children.
- Replace battery only by R&S type battery (R&S ordering number 0565.1687.00)
- Make sure to connect the battery to the appropriate terminals when replacing
- Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.



- *Put the instrument on the front handles before loosing the rear feet and the tube to avoid damage of the instrument.*
- *When mounting the tube take care not to damage or pull off cables.*

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In case of urgent spare parts requirements for this Rohde & Schwarz unit, please contact our spare parts express service.

Outside business hours, please leave us a message or send a fax or e-mail. We shall contact you promptly.

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Contents of Manuals for FSU

Service Manual - Instrument

The service manual - instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the FSU by the replacement of modules.

The service manual comprises four chapters and an annex (chapter 5) containing the FSU circuit documentation:

Chapter 1 provides all the information necessary to check for compliance with rated specifications. The required test equipment is included, too.

Chapter 2 describes the manual adjustment of the calibration source and of the frequency accuracy as well as the automatic adjustment of individual module data following module replacement.

Chapter 3 describes the design as well as simple measures for repair and fault diagnosis, in particular, the replacement of modules.

Chapter 4 contains information on the extension and modification by installing instrument software and retrofitting options.

Chapter 5 describes the shipping of the instrument and ordering of spare parts and contains spare parts lists and exploded views.

Operating Manual

In the operating manual you will find information about the technical specifications, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control.

For introduction typical measurement tasks are explained in detail using the functions of the user interface and program examples.

The operating manual further provides hints on preventive maintenance and fault diagnosis by means of warnings and error messages output by the unit.

Service and Repair

Please contact your Rohde & Schwarz support center or our spare parts express service if you need service or repair of your equipment or to order spare parts and modules.

The list of the Rohde & Schwarz representatives and the address of our spare parts express service are provided at the beginning of this service manual.

We require the following information in order to answer your inquiry fast and correctly and to decide whether the warranty still applies for your instrument:

- Instrument model
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Rohde & Schwarz offers the following calibrations:

- Calibration on R&S-type test systems. The calibration documentation meets the requirements of the quality management system ISO 9000.
- Calibration at an R&S calibration center approved by the German Calibration Service (DKD). The calibration documentation consists of the DKD calibration certificate.

Refer to Chapter 5 for a detailed description on shipping of the instrument and ordering of spare parts.

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1 Performance Test

Test Instructions

- The rated specifications of the analyzer are tested after a warm-up time of at least 15 minutes and overall calibration. Only in this case can the compliance with the guaranteed data be ensured. Starting of overall adjustment: [***CAL*** *: CAL TOTAL*]
- If nothing else is specified, all measurements will be done with external reference frequency.
- Values given in the following sections are not guaranteed. Only the technical specifications of the data sheet are binding.
- The values given in the datasheet are the guaranteed limits. Due to measurement errors these limits must be extended by the tolerance of the measuring equipment used in this performance test.
- Inputs for settings during measurements are shown as following:

  [**<KEY>**] Press a key on the front panel, eg **[SPAN]**

  [<SOFTKEY>] Press a softkey, eg [MARKER -> PEAK]

  [<**nn unit**>] Enter a value and terminate by entering the unit, eg [**12 kHz**]

  Successive entries are separated by [:], eg. [**BW** : RES BW MANUAL : **3 kHz**]

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	accuracy < $1x10^{-9}$, frequency range up to 10 MHz	Advantest R5361B with option 23		Frequency accuracy of reference oscillator
2	Signal generator	FSU3 / FSU8: 10 MHz to 13 GHz FSU26: 10 MHz to 26.5 GHz FSU46: 10 MHz to 46 GHz	SMP02 SMP03 SMR50	1035.5005.02 1035.5005.03 1134.9008.50	Immunity to interference Third-Order Intercept Frequency response
3	Signal generator	1 MHz to 3.6 GHz Phase noise at 640 MHz: < -100 dBc(1 Hz) @ 100 Hz < -115 dBc(1 Hz) @ 1 kHz < -127 dBc(1 Hz) @ 10 kHz < -130 dBc(1 Hz) @ 100 kHz < -142 dBc(1 Hz) @ 1 MHz 1 MHz to 36 MHz +16 dBm output level	SMHU	0835.8011.52	Calibration source 128 MHz 2nd-Order harmonic dist. Third-Order Intercept IF Filters Frequency response Display linearity RF attenuator Reference level switching Phase Noise Frequency response of IQ-path B9: Frequency response of the base band input
4	Signal generator	FSU 8: 3.6 GHz to 8 GHz	SMP02	1035.5005.02	Third-Order Intercept
5	3 or 6-dB coupler (power combiner)	FSU 3: 10 MHz to 3.6 GHz FSU 8: 10 MHz to 8 GHz FSU 26: 10 MHz to 26.5 GHz			Third-Order Intercept
6	6-dB divider (power splitter)	level imbalance 10 MHz to 2.2 GHz ≤ 0.10 dB 2.2 GHz to 7 GHz ≤ 0.2 dB 7 GHz to 18 GHz ≤ 0.3 dB 18 GHz to 26.5 GHz ≤ 0.4 dB FSU 3: 10 MHz to 3.6 GHz FSU 8: 10 MHz to 8 GHz FSU 26: 10 MHz to 26.5 GHz FSU 46: 10 MHz to 46 GHz	Agilent 11667B Agilent 11667C + adapter to K		Frequency response Third-Order Intercept
7	50-Ohm termination	FSU 3: 10 MHz to 3.6 GHz FSU 8: 10 MHz to 8 GHz FSU 26: 10 MHz to 26.5 GHz FSU 46: 10 MHz to 46 GHz	RNA RNA Wiltron 28S50 Anritsu 28K50	0272.4510.50 0272.4510.50	Noise display
8	Power meter	FSU 3/ 8/ 26 FSU 46	NRVD Anritsu ML2438	0857.8008.02	Frequency response Calibration source 128 MHz
9	Power sensor	1 MHz to 3.6 GHz RSS ≤ 0.8 % Meter noise ≤ 20 pW	NRV-Z4 or NRV-Z5	0828.3618.02 0857.9004.02	Frequency response

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
10	Power sensor	RSS referred to indicated Power: 3.6 GHz to 7 GHz ≤2 % 7 GHz to 26.5 GHz ≤3.5 % FSU 3: 10 MHz to 3,6 GHz FSU 8: 3.6 GHz to 8 GHz FSU 26: 3.6 GHz to 26 GHz FSU 46: 3.6 GHz bis 46 GHz	 NRV-Z4 NRV-Z2 NRV-Z55 Anritsu MA2425B or SC6230	 0828.3628.02 0828.3218.02 1081.2005.02	Frequency response
11	Step attenuator	variable attenuation 0 dB to 100 dB, 1-dB steps attenuation accuracy < 0.1 dB (f = 5 MHz)	RSP	0831.3515.02	Reference level switching, Display linearity, RF attenuator
12	Attenuator (2 x)	fixed attenuation 10 dB FSU 3: 10 MHz to 3.6 GHz FSU 8:: 10 MHz to 8 GHz	 DNF DNF	 0272.4210.50 0272.4210.50	Third-Order Intercept
13	Low pass	cut-off frequency: 28 MHz, 107 MHz, 262 MHz. 640 MHz, 1000 MHz, 1700 MHz	ATS-OW	1000.1755.20	2nd-order harmonic distortion.
14	VSWR-Bridge	directtivity >30 dB FSU 3 : 10 MHz to 3.6 GHz FSU 8: 10 MHz to 8 GHz	ZRC Wiltron 87A50 with adapter 34AN50, Open/Short 22NF50	1039.9492.55	VSWR FSU 3 and FSU 8
15	Network Analyzer	FSU 26: 10 MHz to 26.5 GHz FSU 46: 10 MHz to 40 GHz	ZVK		VSWR FSU 26, 46, or as alternative to 14
16	IQ-Base Band Generator	Frequency range up to 10 MHz 2 sinusoidal signals with 90 deg phase difference	AMIQ	1110.2003.03	B9: test of modulation
17	Volt meter	DC and AC voltage	URE02 URE03	0350.5315.02 0350.5315.03	B9: test of modulation
18	N cable	attenuation < 0.2 dB up to 3.6 GHz			B9/B12: test of output level
19	Spectrum Analyzer	Frequency range up to 3,6 GHz	FSU 3	1129.9003.03	B9: test of modulation
20	WinIQSIM	PC test program for AMIQ			B9: Generation of data for modulation test.
21	Software: Modulation test 100 kHz	Setup files for AMIQ with modulated signal 100 kHz		1142.9232.00	B9: test FM
22	Software modulation test 1 MHz + 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with + 90 deg phase shift between I- and Q- channel		1142.9249.00	B9: test AM; Test of I/Q-modulation with + 90 deg phase shift
23	Software modulation test 1 MHz - 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with - 90 deg phase shift between I- and Q- channel		1142.9255.00	B9: test AM; Test of I/Q-modulation with – 90 deg phase shift

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
24	PC	Windows, LAN and RSIB SW or GPIB interface			Frequency Response of IQ-path B9, B71
25	not used				
26	Power sensor	Frequency range 7.0 GHz up to 15.5 GHz max. power input + 23 dBm RSS referred to indicated Power ≤ 2.5 %	NRV-Z55	1081.2005.02	B21: test LO output power
27	attenuator	fixed attenuation 10 dB up to 18 GHz	Wiltron 41KA-10		B21: test LO output power
29	DC-current meter	Max. current 50 mA uncertainty +/- 0.01 mA			B21: mixer bias current source

Performance Test FSU

Checking the Reference Frequency Accuracy

Test equipment:
Frequency counter (Section "Measurement Equipment", item 1):
Accuracy < $1x10^{-9}$
Frequency range up to 10 MHz

Test setup:
➢ Connect frequency counter to 10-MHz reference output of the FSU (rear panel)

FSU settings:
- [**SETUP** : REFERENCE INT / EXT]
➢ Toggle to internal reference (INT)

Measurement:
➢ Measure frequency with frequency counter

Nominal frequency:
Model without option B4..... 10 MHz ± 1 Hz
Model with option B4 .....10 MHz ± 0.3Hz

Note:
The frequency of the reference oscillator can be adjusted by means of a service function (see chapter "Adjustment")

Checking Immunity to Interference

Test equipment:
Signal generator (Section "Measurement Equipment", item 2):

Frequency range	FSU 3, 8:	10 MHz to 13 GHz
	FSU 26:	10 MHz to 26 GHz
	FSU 46:	10 MHz to 41 GHz
	maximum level	≥ 0 dBm

Test setup:
➢ Connect RF output of the signal generator to RF input.

Signal generator settings:
Level: adjust the output level of signal generator for an RF-Input level of 0 dBm

FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : REF LEVEL : **-30 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]

1st IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 9256.8 MHz

Additional FSU settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}

Measurement: ➢ Set marker to peak of signal
[**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):
Image frequency rejection = 0dBm – L_{dis}

2nd IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 808.8 MHz

Additional FSU settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement: ➢ Set marker to peak of signal
[**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):
Image frequency rejection = 0dBm – L_{dis}

3rd IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 40.8 MHz

Additional FSU settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement: ➢ Set marker to peak of signal
[**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):
Image frequency rejection = 0dBm – L_{dis}

1st IF Rejection

Additional signal generator settings: - Frequency 4628.4 MHz

Additional FSU settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement: ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

IF rejection = 0dBm – L_{dis}

2nd IF Rejection

Additional signal generator settings: - Frequency +/- 808.8 MHz
see table "performance test report" for explanation of "+/-"

Additional FSU settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement: ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

IF rejection = 0dBm – L_{dis}

Checking Nonlinearities

Third-Order Intercept Point

Test equipment:

- 2 signal generators
  - FSU 3: Section "Measurement Equipment", item 2 and 3
  - FSU 8, FSU 26 Section "Measurement Equipment", item 2, 3, 4
  - Frequency range:
    - FSU 3: 10 MHz to 3.6 GHz
    - FSU 8: 10 MHz to 8 GHz
    - FSU 26: 10 MHz to 26.5 GHz
    - FSU 46: 10 MHz to 40 GHz

- 2 attenuators (Section "Measurement Equipment", item 12)
  - Attenuation a_{ATT} = 10 dB
  - Frequency range
    - FSU 3: 10 MHz to 3.6 GHz
    - FSU 8: 10 MHz to 8 GHz
    - FSU 26: 10 MHz to 26.5 GHz
    - FSU 46: 10 MHz to 40 GHz

- Power combiner (Section "Measurement Equipment", item 5)
  - Frequency range
    - FSU 3: 10 MHz to 3.6 GHz
    - FSU 8: 10 MHz to 8 GHz
    - FSU 26: 10 MHz to 26.5 GHz
    - FSU 46: 10 MHz to 40 GHz

Test setup:

- Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the combiner
- Connect output of the combiner to the RF input of the FSU.

Signal generator settings: (both generators)

- Frequency: generator 1 $f_{g1} = f_{in} - 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz

See table of performance test report for values of f_{in}

- Adjust the output level of the signal generators for an input level at the FSU of –10 dBm.
- Switch off the ALC of the generators to reduce the interference between the generators

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}

Measurement

- [**MKR FCTN** : TOI]

Evaluation:

The third order intercept point (T.O.I) referred to the input signal is displayed in the marker field by the reading [TOI].

Second-Order Harmonic Distortion

Test equipment:

➢ - Signal generator (Section "Measurement Equipment", item 3)

➢ Frequency range: 9 kHz to 1.8 GHz

Recommended harmonic suppression:

f <100 MHz :	>35 dBc
100 MHz < f < 1 GHz :	>45 dBc
f >1 GHz :	>35 dBc

In order to improve the harmonic suppression of the generator it is recommended to insert a lowpass filter with a suitable cut-off frequency (Section "Measurement Equipment", item 13) after the generator.

Test setup:

➢ Connect RF output of signal generator to the input of the lowpass

➢ Connect the output of the lowpass to the RF input of the FSU

Note:

If the harmonic suppression of the signal generator is sufficient, the lowpass can be left out.
The RF output of the generator can be connected directly to the RF input of the FSU *in this case.*

Signal generator settings:

- Level: 0 dBm
- Frequency: f_{in}

see table of performance test report for values of f_{in}

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **3 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**FREQ :** CENTER : { f_{in} }]

See table of performance test report for values of f_{in}

Measurement:

➢ Set marker to peak of signal

- [**MKR** ⇒ : PEAK]

The level of the input signal L_{IN} is displayed by the marker reading for marker 1.

➢ Set center frequency of the FSU to the frequency of the 2nd harmonic

- [**FREQ** : CENTER : {2 x f_{in}}]

Measurement:

➢ Set marker to peak of the 2nd harmonic

- [**MKR** ⇒ : PEAK]

The level of the harmonic signal L_{K2} is displayed by the marker reading for marker 1.

Evaluation:

The second order harmonic distortion can be calculated as

$$IP_{k2} / dBm = (L_{IN} - L_{K2}) + L_{IN}$$

Checking IF Filters

Test equipment: Signal generator (Section "Measurement Equipment", item 3):
Frequency 128 MHz
Level ≥ 0 dBm

Test setup: ➢ Connect RF output of the signal generator to the RF input of the FSU.

Checking the bandwidth switching level accuracy

Reference measurement (RBW 10 kHz)

Signal generator settings:
- Frequency: 128 MHz
- Level: -30 dBm

FSU settings:
- [**PRESET**]
- [**AMPT** : **-30 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **5 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : RBW MANUAL : **10** : **kHz**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Checking the level accuracy

FSU settings:
- [**SPAN** : {0.5 x RBW}]
- [**BW** : RBW MANUAL : {RBW} : **ENTER**]

Note:

To check the FFT- filter, the resolution bandwidth has to be set manually to FFT mode.

- [**BW** : BW MODE : FFT]

Measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The level difference is displayed in the marker field by the reading ´Delta [T1 FXD] {xxx} dB´.

Checking Bandwidth

Signal generator settings:
- Frequency: 128 MHz
- Level: -10 dBm

FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **3** : **ENTER**]

➢ Determine 3-dB-Bandwith
- [**MKR FCTN** : N DB DOWN : **3 dB**]
- [**SPAN** : {3 x RBW}]

See table of performance test report for values of RBW.

Note:

To check the filters > 3 MHz. the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5, 10, 20 or 50 MHz

Measurement:
- [**MKR** ⇒ : PEAK]

The 3 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Checking the Shape Factor

Note: *To check the shape factor the values of the 3 dB bandwith will be needed. Please check before this measurement.*

Signal generator settings:
- Frequency: 128 MHz
- Level: 0 dBm

FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **20 ENTER**]
- [**BW** : COUPLING RATIO : RBW/VBW NOISE [10]]
- [**MKR FCTN** : N DB DOWN : **60 dB**]
- [**SPAN** : {20 x RBW}]

See table of performance test report for values of RBW.

Note:

To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5, 10, 20 or 50 MHz

Measurement:
- [**MKR** ⇒ : PEAK]

The 60 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Evaluation:

The shape factor is calculated by BW (60dB) / BW (3dB).

Checking Noise Display

Test equipment: 50 Ω termination (Section "Measurement Equipment", item 7)
Frequency range

FSU 3:	DC to 3.6 GHz
FSU 8:	DC to 8 GHz
FSU 26:	DC to 26.5 GHz
FSU 46	DC to 46 GHz

Test setup:
- Terminate the RF input of the FSU with 50 Ω

FSU settings:

Measurement for $f_n \leq 1$ kHz:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **10 Hz**]
- [**BW** : BW MODE : **FFT**]
- [**BW** : RES BW MANUAL : **10 Hz**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]

Measurement for $f_n > 1$ kHz:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [SPAN : 0 Hz]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]
- [**MEAS** : Time Dom Power : **Mean**]

See table below for values of RefLev.

See table of performance test report for values of f_n.

Measurement:
- Set the marker to the center frequency for the value below or equal 1 kHz.
- Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –20 dB for the ratio of 10 Hz / 1 kHz .

Note: For example the DANL in 1 kHz bandwidth –126 dBm results in a corrected value of –146 dBm in 10 Hz bandwidth.
As both filter designs are digitally and using the same hardware setting, the DANL can be measured also with 1 kHz bandwidth to reduce measurement time.

Evaluation: The noise level is displayed by the level reading of marker 1.

Frequency	< 10kHz	< 100kHz	< 1MHz	< 10MHz	> 10kHz
RefLev	-10 dBm	-20 dBm	-30 dBm	-60 dBm	-60 dBm

Checking the Level accuracy and the Frequency Response

Test equipment:

- Signal generator :

FSU 3:	Section "Measurement Equipment", item 3
FSU 8, 26, 46	Section "Measurement Equipment", item 3 and 4

Frequency range	FSU 3:	to 3.6 GHz
	FSU 8:	to 8 GHz
	FSU 26:	to 26.5 GHz
	FSU 46:	to 46 GHz
Maximum level	≥ 0 dBm	

- Power meter (Section "Measurement Equipment", item 8)

- Power sensor :

FSU 3:	Section "Measurement Equipment", item 9
FSU 8, 26, 46:	Section "Measurement Equipment", item 9 and 10

Impedance Z = 50 Ω

- 6 dB divider (Section "Measurement Equipment", item 6)

Frequency range	FSU 3:	to 3.6 GHz
	FSU 8:	to 8 GHz
	FSU 26:	to 26.5 GHz
	FSU 46:	to 46 GHz
Level imbalance[1])	1 MHz to 3.6 GHz	≤ 0.1 dB
	3.6 GHz to 8 GHz	≤ 0.2 dB

[1]) If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

Determining the level accuracy at 128 MHz

Test setup:

- ➢ Connect power sensor (item 9) to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor
- ➢ Connect power sensor to RF output of signal generator

Signal generator settings:

- Frequency 128 MHz
- Level -30 dBm

Measurement:

- ➢ Determine output power of the signal generator with the power meter
- ➢ Connect RF output of the signal generator to RF input of the FSU

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-30 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

➢ Set marker to peak of signal

- [**MKR** ⇒ : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the FSU (level reading of marker 1) reflects the absolute level accuracy of the FSU. It can be calculated as:

$$\text{Level accuracy}_{128\text{MHz}} = {}_{\text{LFSU}} - L_{\text{powermeter}}$$

Checking the frequency response

Test setup:

- ➢ Connect RF output of the signal generator to input of the divider
- ➢ Connect output 1 of the divider to the power sensor / power meter
- ➢ Connect output 2 of the divider to RF input of the FSU

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Reference measurement:

- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level L_{FSU} is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSU} - L_{powermeter}$$

Measurement

Signal generator settings:

- Frequency f_{fresp}

See table of performance test report for values of f_{fresp}

Power meter settings:

Determine signal level $L_{powermeter}$. To achive higher accuracy it is recommended to compensate the frequency response of the power sensor.

FSU settings:

- [**FREQ** : CENTER : {f_{fresp}}]

See table of performance test report for values of f_{fresp}

- ➢ - Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level $_{LFSU}$ is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as:

$$\text{Frequency response} = L_{FSU} - L_{powermeter} - Ref_{128\ MHz}$$

Checking the Display Linearity

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  Frequency 5 MHz [1)]
  Maximum level ≥ 10 dBm

- Step attenuator (Section "Measurement Equipment", item 11)
  Frequency 5 MHz [1)]
  Attenuation 0 to 100 dB in 1 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator

➢ Connect RF output of the step attenuator to RF input of the FSU

Signal generator settings:

- Frequency 5 MHz [1)]
- Level +10 dBm

Step attenuator settings:

Attenuation 20 dB

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** :CENTER : **5 MHz**]
- [**SPAN** : **0 Hz**]
- [**TRACE** : DETECTOR : RMS]

1. Measurement:
- [**BW** : RES BW MANUAL : **500 Hz**]

2. Measurement:
- [**BW** : RES BW MANUAL : **300 kHz**]

3. Measurement:
- [**BW** : RES BW MANUAL : **20 MHz**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings:

Attenuation $\{a_{ATT}\}$

See table of performance test report for values of a_{ATT}.

Evaluation:

The difference between the level of the input signal of the FSU and the reference (about 10 dB below the reference level) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

[1)] A frequency between 5 MHz and 1 GHz may be used. It is recommended to use correction values for the uncertainty of the attenuator.

Checking the RF Attenuator

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ 0 dBm

- Step attenuator (Section "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 80 dB in 5 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator
➢ Connect RF output of the step attenuator to RF input of the FSU

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings: Attenuation 70 dB

FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-30 dBm**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation { 80dB - a_{FSU} }
See table below for values of a_{ATT}.

FSU settings:

- [**AMPT** : RF ATTEN MANUAL : { a_{FSU} }]
- [**AMPT** : {-40dBm + a_{FSU} } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a_{FSU} , a_{ATT} and reference level.

Evaluation: The difference between the level of the input signal of the FSU and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading Delta [T1 FXD].

a_{ATT}	80 dB	75 dB	70 dB	60 dB	40 dB
a_{FSU}	0 dB	5 dB	10 dB	20 dB	40 dB
reference level	-40 dBm	-35 dBm	-30 dBm	-20 dBm	0 dBm

Checking the Reference Level Switching (IF-Gain)

Test principle:

The IF gain of the FSU can be switched from 0 to 50 dB by changing the reference level at fixed RF attenuation. To prevent the IF gain accuracies to be mixed up with the log amplifier accuracy it is determined by comparison using an external precision attenuator.

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  frequency 5 MHz
  maximum level ≥ -10 dBm
- Step attenuator (Section "Measurement Equipment", item 11)
  frequency 5 MHz
  attenuation 0 to 60 dB in 1 dB steps
  attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator

➢ Connect RF output of the step attenuator to RF input of the FSU

Signal generator settings:

- frequency 5 MHz
- level -10 dBm

Step attenuator settings:

Attenuation 20 dB

FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **5 MHz**]
- [**SPAN** : **2 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**TRACE** : DETECTOR : RMS]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10 dBm**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation $\{a_{ATT}\}$

See table below for values of a_{ATT}.

FSU settings: - [**AMPT** : {reference level} **dBm**]

See table below for values of reference level.

- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the level of the input signal of the FSU and the reference (at 10 dB IF-Gain) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

10 dB gain steps:

a_{ATT}	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB
reference level	0 dBm	-10 dBm	-20 dBm	-30 dBm	-40 dBm	-50 dBm

1 dB gain steps:

a_{ATT}	20 dB	21 dB	22 dB	23 dB	24 dB	25 dB	26 dB	27 dB	28 dB	29 dB
reference level	-10 dBm	-11 dBm	-12 dBm	-13 dBm	-14 dBm	-15 dBm	-16 dBm	-17 dBm	-18 dBm	-19 dBm

Checking the Phase Noise

Test equipment:

Signal generator (Section "Measurement Equipment", item 3)

Frequency	640 MHz
Level	≥ 0 dBm
Phase Noise at 640 MHz:	< -100 dBc/Hz @ 100 Hz
	< -115 dBc/Hz @ 1 kHz
	< -127 dBc/Hz @ 10 kHz
	< -130 dBc/Hz @ 100 kHz
	< -142 dBc/Hz @ 1MHz

Test setup:

- ➢ Connect RF output of the signal generator to RF input of the FSU
- ➢ The external reference of the two instruments should be disconnected to avoid correlation of the synthesizer phase noise.

Signal generator settings:

- Frequency 640 MHz
- Level 0 dBm

Fineadjust the frequency of the generator so that the FSU shows exactly 640 MHz .

FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **640 MHz**]
- [**AMPT** : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : {span}]
- [**Ext Ref** : **INT**]

Depending on offset, see table below for values of span.

- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**BW** : RBW MANUAL : {RBW}]

Depending on offset, see table below for values of RBW.

- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]

➢ Activate phase noise marker

- [**MKR FCTN**: PHASE NOISE]
- [**FREQ** : CENTER : {640 MHz + offset}]

See table below for values of offset.

- [**AMPT** : {reference level}]

Depending on offset, see table below for values of reference level.

- [**AMPT** : RF ATTEN MANUAL : {a_{FSU}}]

Depending on offset, see table below for values of a_{FSU} .

➢ Set phase noise marker
[**MKR :** MARKER 2 : {offset}]

See table below for values of offset.

***Note**: Please make sure not to measure on a spurious signal.*

Evaluation:

The phase noise is displayed in the marker field by the reading Delta 2 [T1 PHN].

Phase noise measurement settings				
Offset	**Span**	**RBW**	**Reference level**	**a** FSU
100 Hz	20 Hz	30 Hz	0 dBm	10 dB
1 kHz	200 Hz	100 Hz	0 dBm	10 dB
10 kHz	2 kHz	300 Hz	0 dBm	10 dB
100 kHz	10 kHz	3 kHz	-10 dBm	0 dB
1 MHz	100 kHz	30 kHz	-30 dBm	0 dB

Note: *To obtain a precise measurement of the phase noise at high offsets the level used at the FSU input is 10 to 30 dB higher than the reference level. To reduce the measurement time the phase noise is measured with a small span around the frequency offset. This prevents the FSU from being overloaded.*

Checking the Return Loss at the RF Input

Note: For FSU 3 or FSU 8 as alternative to the VSWR bridge a network analyzer (item 14a) can be used also. For FSU 26, 46 it is recommanded to use a network analyzer for better accuracy.

Test equipment:

FSU 3, 8:

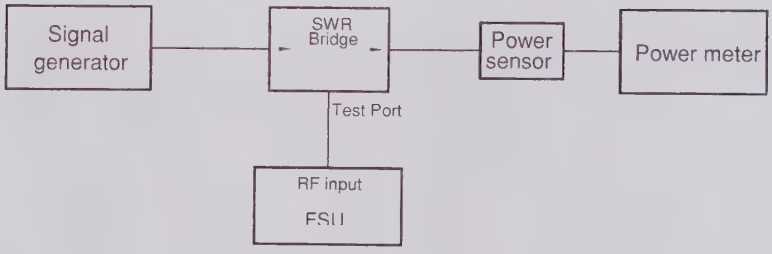
- Signal generator (Section "Measurement Equipment", item 2)
  Frequency range FSU 3: 10 MHz bis 3,6 GHz
  FSU 8 10 MHz bis 8 GHz
  Level range ≥ -10 dBm
- Power meter (Section "Measurement Equipment", item 8)
- Power sensor
  Frequency range FSU 3: 10 MHz to 3,6 GHz
  FSU 8: 10 MHz to 8 GHz
- SWR bridge (Section "Measurement Equipment", item 14)
  Frequency range FSU 3: 10 MHz to 3,6 GHz
  FSU 8: 10 MHz to 8 GHz

FSU 26, 46:

- Network analyzer (Section "Measurement Equipment", item 2)

Test setup:

FSU 3, 8:



FSU 26, 46:

Connect the network analyzer to the RF input of the FSU

Signal generator settings:

- Level -10 dBm
- Frequency $\{f_{in}\}$

See performance test report for values of f_{in}.

FSU settings:

- [**SYSTEM PRESET**]
- [**INPUT** : RF ATTEN MANUAL : **10 dB**]

Calibration:

FSU 3 / FSU 8:

➢ Use total reflection (OPEN or SHORT) at the test port of the SWR bridge as a reference:

➢ Remove cable from RF input of the FSU and connect precision short or open to the cable. Determine reflected power with the power meter and store measured level LRef as reference. Repeat this procedure for every measurement over the whole frequency range.

Measurement:

FSU 3 / FSU 8:

- Connect the RF input of the FSU to the test port of the SWR bridge.
- Measure reflected power L_r with the power meter. The return loss a_r of the RF input of the FSE can be calculated as:

  $a_r = L_{Ref} - L_r$.

  The VSWR can be calculated as:

$$s = \frac{10^{0.05a_r} + 1}{10^{0.05a_r} - 1}$$

FSU 26, 46:

- Determine S_{11} of the FSU at the frequencies shown in the performance test report. See operating manual of the network analyzer for detailed information about S_{11} measurement.

Test Procedure Option Tracking Generator - B9 with Option Attenuator - B12

Checking the output level

Test equipment:

- N cable (section "Measurement Equipment", item 18)

Frequency	up to 3.6 GHz
Maximum attenuation	< 0.2 dB

Test setup:

➢ Connect the tracking generator output to the RF input of the FSU.

FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **300 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**TRACE** : AVERAGE : SWEEP COUNT : **10 ENTER]**
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:
{level}: check from 0 dBm to –20 dBm in 5 dB steps

With option B12:
{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm
- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0e (after entering the password)
{level} : check from 0 dBm to –20 dBm in 5 dB steps
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0

Measurement:

Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Read the value and store it as a reference for the frequency response measurement.

Checking the frequency response

Test equipment:
- N cable (section "Measurement Equipment", item 18)
  Frequency up to 3.6 GHz
  Maximum attenuation < 0.2 dB

Test setup:
Connect the tracking generator output to the RF input of the FSU.

FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**AMPT** : RF INPUT DC] not for FSU 46
- [**FREQ** : START : **100 kHz**]
- [**FREQ** : STOP : **3.6 GHz**]
- [**BW** : RES BW MANUAL : **30 kHz**]
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:
{level} : check from 0 dBm to –20 dBm in 5 dB steps

With option B12:
{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm
- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0.
{level}: check from 0 dBm to –20 dBm in 5 dB steps
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0.

Measurement:
Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Set marker to minimum value:
- [**MKR** ⇒ : NEXT : MIN]

Evaluation:
The difference between the min and max of the reference value at 128 MHz yields the frequency response.

Checking the dynamic range

Test equipment:
- N cable (section "Measurement Equipment", item 18)
  Frequency up to 3.6 GHz
  Maximum attenuation < 0.2 dB

Test setup:
Connect the tracking generator output to the RF input of the FSU.

FSU settings:
- [**PRESET**]
- [**FREQ : 128 MHz**]
- [**SPAN** : ZERO SPAN]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**AMPT** : RANGE LOG MANUAL : **120 dB**]
- [**NETWORK** : SOURCE POWER : **0 dBm**]
- [**MKR** : REFERENCE FIXED]

Disconnect the cable and connect a 50 Ω termination to the tracking generator output and the RF input.

Measurement:
- [**TRACE** : AVERAGE : SWEEP COUNT : **50 ENTER]**

Read off delta marker

Checking Modulation

Checking the I/Q modulator

Test equipment:
- AMIQ (section "Measurement Equipment", item 16)
- Spectrum analyzer (section "Measurement Equipment", item 19)

Test setup:
➢ Connect the the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer. Ensure that the modulation lines are equal (phase shift).

➢ Connect the spectrum analyzer to the tracking generator output.

AMIQ settings
➢ AMIQ self-adjustment
AC voltage I output: U = 0.5 V
AC voltage Q output: U = 0.5 V

Frequency: 1 MHz
Phase (I/Q) = +/-90 degrees
(For this purpose, use AMIQ setup files from section "Measurement Equipment", items 22 and 23.)

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **10 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

FSU settings:
- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm**]
- [MODULATION: EXT I/Q]

Measuring the residual carrier:
➢ Switch off the I and Q channels on the AMIQ.

➢ Set marker to peak of signal:

- [**MKR** ⇒ : PEAK]

Read off the measured value on the spectrum analyzer (Marker Peak)

Measuring the impairment (imbalance between the I and Q path):
➢ Switch on the I and Q channels on the AMIQ.
Measure the carrier amplitude at 1 GHz and the lateral component amplitudes at 1 GHz + 1 MHz and 1 GHz - 1 MHz.
Perform this measurement for baseband signals with a phase shift of +90 degrees and –90 degrees between the I and Q channel.

Checking the amplitude modulation

Test equipment:
- AMIQ (section "Measurement Equipment", item 16)
- Spectrum analyzer (section "Measurement Equipment", item 19)

Test setup:
➢ Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.

➢ Connect the spectrum analyzer to the tracking generator output.

AMIQ settings:

➢ AMIQ self-adjustment
AC voltage I output: U = 0.5 V
AC voltage Q output: U = 0 V
Frequency: 1 MHz
(For this purpose, use AMIQ setup files from section "Measurement Equipment", item 22)

Spectrum analyzer settings:

- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **10 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

FSU settings:

- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm]**
- [MODULATION : EXT AM]

Measurement:

➢ Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 1 MHz.

Checking the frequency modulation

Test equipment:

- AMIQ (section "Measurement Equipment", item 16)
- Spectrum analyzer (section "Measurement Equipment", item 19)

Test setup:

➢ Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.

➢ Connect the spectrum analyzer to the tracking generator output.

AMIQ settings:

➢ AC voltage I output: U = 0 V
AC voltage Q output: U = 0.5 V
Frequency: 100 kHz
(For this purpose, use AMIQ setup files from section "Measuring Equipment", item 21)

Spectrum analyzer settings:

- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **1 MHz**]
- [**BW** : **10 kHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

FSU settings:

- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm**]
- [MODULATION : EXT FM : **100 kHz**]

Measurement:

➢ Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 100 kHz.

Performance Test Option Electronic Attenuator- B25

Comment: With FSU 26, 46 the option B25 is implemented in the signal path below 3.6 GHz. Therefore the measurements are done up to 3.6 GHz only.

Checking Noise Display with Preamplifier (B25)

Test equipment:

50 Ω termination (Section "Measurement Equipment", item 7)

Frequency range: FSU 3, 26, 46 to 3.6 GHz
FSU 8 to 8 GHz

Test setup:

➢ Terminate the RF input of the FSU with 50 Ω

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **10 Hz**]
- [**BW** : VIDEO BW MANUAL : **1 Hz**]
- [**BW** : SWEEP TIME MANUAL : **0.1 s**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : **- 80 dBm**]
- [**SETUP** : PREAMP ON]
- [**FREQ** : CENTER : $\{f_n\}$]

Measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation:

The noise level is displayed by the level reading of marker 1.

Checking the Level accuracy and the Frequency Response with Preamplifier

Test equipment:

- Signal generator :
  FSU 3, 26, 46: Section "Measurement Equipment", item 3
  FSU 8: Section "Measurement Equipment", item 3 and 4

  Frequency range:
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz

  Maximum level ≥ 0 dBm

- Power meter (Section "Measurement Equipment", item 8)
- Power sensor :
  FSU 3, 26 / 46: Section "Measurement Equipment", item 9
  FSU 8: Section "Measurement Equipment", items 9 and 10

  Frequency range:
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz

  Maximum power $P_{max} \geq 100\ \mu W$

  Impedance Z = 50 Ω

- 6 dB divider (Section "Measurement Equipment", item 6)

  Frequency range:
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz

  Level imbalance[1)] 1 MHz to 1 GHz ≤ 0.1 dB
  1 GHz to 8 GHz ≤ 0.2 dB

[1)] If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

Determining the level accuracy at 128 MHz

Test setup:

➢ Connect power sensor (item 9) to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor

➢ Connect power sensor to RF output of signal generator

Signal generator settings:

- Frequency 128 MHz
- Level -30 dBm

Measurement:

➢ Determine output power of the signal generator with the power meter

➢ Connect RF output of the signal generator to RF input of the FSU

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-20 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **10 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the FSU (level reading of marker 1) reflects the absolute level accuracy of the FSU. It can be calculated as:

$$\text{Level accuracy}_{128\text{MHz}} = L_{FSU} - L_{powermeter}$$

Checking the frequency response

Test setup:

- ➢ Connect RF output of the signal generator to input of the divider
- ➢ Connect output 1 of the divider to the power sensor / power meter
- ➢ Connect output 2 of the divider to RF input of the FSU

Signal generator settings:

- level 0 dBm
- frequency 128 MHz

FSU settings

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Reference measurement:

- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level $_{LFSU}$ is displayed by the level reading of marker 1.

$$Ref_{128MHz} = {}_{LFSU} - L_{powermeter}$$

Measurement

Signal generator settings:

- Frequency f_{fresp}

See table of performance test report for values of f_{fresp}

Power meter settings:

Determine signal level $L_{powermeter}$. To achive higher accuracy it is recommended to compensate the frequency response of the power sensor.

FSU settings:

- [**FREQ** : CENTER : {f_{fresp}}]

See table of performance test report for values of f_{fresp}.

Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level $_{LFSU}$ is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as:

$$\text{Frequency response} = {}_{LFSU} - L_{powermeter} - Ref_{128\ MHz}$$

Checking the Frequency Response with Electronic Attenuator

Test equipment:

- Signal generator :
  FSU 3, 26 / 46: Section "Measurement Equipment", item 3
  FSU 8: Section "Measurement Equipment", item 3 and 4

  Frequency range:
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz

  Maximum level ≥ 0 dBm

- Power meter (Section "Measurement Equipment", item 8)
- Power sensor :
  FSU 3, 26 / 46: Section "Measurement Equipment", item 9
  FSU 8: Section "Measurement Equipment", items 9 and 10

  Frequency range:
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz

  Maximum power $P_{max} \geq 100\ \mu W$

  Impedance $Z = 50\ \Omega$

- 6 dB divider (Section "Measurement Equipment", item 6)

  Frequency range:
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz

  Level imbalance[1]) 1 MHz to 1 GHz ≤ 0.1 dB
  1 GHz to 8 GHz ≤ 0.2 dB

  [1]) If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

Test setup:

- ➢ Connect RF output of the signal generator to input of the divider
- ➢ Connect output 1 of the divider to the power sensor / power meter
- ➢ Connect output 2 of the divider to RF input of the FSU

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {E_{ATT}} : **dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

See table of performance test report for values of E_{ATT} .

Reference measurement:

- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]

The signal level L_{FSU} is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSU} - L_{powermeter}$$

Measurement

Signal generator settings:

- Frequency f_{fresp}

See table of performance test report for values of f_{fresp}

Power meter settings:

Determine signal level $L_{powermeter}$. To achieve higher accuracy it is recommended to compensate the frequency response of the power sensor.

FSU settings:

- [**FREQ** : CENTER : {f_{fresp}}]

see table of performance test report for values of f_{fresp}.

Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level L_{FSU} is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as:

$$\text{Frequency response} = L_{FSU} - L_{powermeter} - Ref_{128\,MHz}$$

Checking Nonlinearities with Electronic Attenuator

Third-Order Intercept

Test equipment:

- 2 signal generators
  FSU 3, 26 / 46: Section "Measurement Equipment", item 2 and 3
  FSU 8: Section "Measurement Equipment", item 2 and 4
  Frequency range:
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz
  Maximum level ≥ 0 dBm
- 2 attenuators (Section "Measurement Equipment", item 12)
  Attenuation a_{ATT} = 10 dB
  Frequency range
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz
- Coupler (Section "Measurement Equipment", item 5)
  Frequency range
  FSU 3, 26 / 46: 10 MHz to 3.6 GHz
  FSU 8: 10 MHz to 8 GHz
  Decoupling > 12 dB

Test setup:

- ➢ Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the coupler
- ➢ Connect output of the coupler to the RF input of the FSU.

Signal generator settings: (both generators)

Frequency: generator 1 $f_{g1} = f_{in} - 50$ kHz
generator 2 $f_{g2} = f_{in} + 50$ kHz

See table of performance test report for values of f_{in}

Adjust the output level of signal generators for an input level at the FSU of –20 dBm.

FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement

- ➢ [**MKR FCTN** : TOI]

Evaluation:

The third order intercept point (T.O.I) referred to the input signal is is displayed in the marker field by the reading [TOI].

Checking the RF Attenuator (with Option B25)

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  frequency 128 MHz
  maximum level ≥ 10 dBm
- Step attenuator (Section "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 80 dB in 5 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator.

➢ Connect RF output of the step attenuator to RF input of the FSU.

Signal generator settings:

- Frequency 128 MHz
- Level 10 dBm

Step attenuator settings: Attenuation 70 dB

FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-35 dBm**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement:

Step attenuator settings: Attenuation { 80dB - a_{FSU} }
See table below for values of a_{ATT}.

, settings:

- [**AMPT** : RF ATTEN MANUAL : {a_{FSU}}]
- [**AMPT** : {-45dBm + a_{FSU} } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a_{FSU} , a_{ATT} and reference level.

Evaluation: The difference between the level of the input signal of the FSU and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT} in dB	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
a_{FSU} in dB	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
Ref.level in dBm	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30

Checking the electronic Attenuator accuracy

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  - Frequency 128 MHz
  - Maximum level ≥ 0 dBm
- Step attenuator (Section "Measurement Equipment", item 11)
  - Frequency 128 MHz
  - Attenuation 0 to 40 dB in 5 dB steps
  - Attenuation accuracy < 0.1 dB

Test setup:

- ➢ Connect RF output of the signal generator to RF input of the step attenuator
- ➢ Connect RF output of the step attenuator to RF input of the FSU

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings:

attenuation 40 dB

FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **- 30 dBm**]

Reference measurement:

- ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]
- ➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement:

Step attenuator settings:

Attenuation { 40dB - a_{FSU} }
See table below for values of a_{ATT}.

FSU settings:

- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {a_{FSU}}]
- [**AMPT** : {-30dBm + a_{FSU} } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a_{FSU} , a_{ATT} and reference level.

Evaluation:

The difference between the level of the input signal of the FSU and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT}	40 dB	35 dB	20 dB	25 dB	20 dB	15 dB	10 dB
a	0 dB	5 dB	10 dB	15 dB	20 dB	25 dB	30 dB
Reference level	-30 dBm	-25 dBm	-20 dBm	-15 dBm	-10 dBm	-5 dBm	0 dBm

Performance Test Option External Mixing B21

Checking LO-Pegels

Measurement equipment:

- Power sensor (section "Measurement Equipment", item 26)
  Frequency range 7.0 MHz to 15.5 GHz
  Max. input power P_{max} + 23 dBm
  RSS ≤ 2.5% referred to measured power
  Impedance Z = 50 Ω
- Power Meter (Section "Measurement Equipment", item 8)
- Fixed attenuator with 10 dB (Section "Measurement Equipment" item 27)

Power meter settings:

- Connect power sensor to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor.

FSU settings:

- [**SYSTEM PRESET**]
- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:
  Band: USER
  Harmonic # 20
- [**FREQUENCY SPAN** : ZERO SPAN]
- [**FREQUENCY CENTER** : {f_c}]
  f_c see table

Power meter settings:

- Connect power sensor via fixed attenuator to the output 'LO_{out} / IF_{in}'

Measurement:

- Determine level of the LO-signal $L_{LO,meas}$. To achive higher accuracy it is recommended to compensate the frequency response of the power sensor

Evaluation:

The level of the LO-signal can be determined as:

$$L_{LO} = L_{LO,meas} + 10\ dB$$

Checking the input LO_{out} / IF_{in} (2-Port-Mixers)

Measurement equipment:
- Generator (section "Measurement Equipment", item 2 or 3)
  frequency f = 404.4 MHz
  output power P = - 20 dBm

FSU settings:
- [**SYSTEM PRESET**]
- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:

Band:	USER
Ports	2
Bias	0 mA
AVG Conv Loss	20 dB

Switch off LO with service function:
- [**SETUP :** SERVICE : ENTER PASSWORT **894129**]
- [**SETUP :** SERVICE FUNCTION: **2.18.1.0**]

Test setup:
- Connect the generator to the connector LO_{out} / IF_{in};
  Input level P = – 20 dBm +/- 0,1 dB

Evaluation:
- [**MKR->** : PEAK]

Checking the input IF_{in} (3-Port-Mixers)

Measurement equipment:
- item (section "Measurement Equipment", item 2 or 3)
  frequency f = 404.4 MHz
  output level P = - 20 dBm

FSU settings:
- [**SYSTEM PRESET**]
- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:

Band:	USER
Ports	3
Bias	0 mA
AVG Conv Loss	20 dB

Switch off LO with service function:
- [**SETUP :** SERVICE : ENTER PASSWORT **894129]**
- [**SETUP :** SERVICE FUNCTION : **2.18.1.0**]

Test setup:
- Connect the generator to the connector IF_{in}.
  Input level P = – 20 dBm +/- 0,1 dB

Evaluation:
- [**MKR->** : PEAK]

Checking the bias supply

Measurement equipment:
- DC-current meter (section "Measurement Equipment", item 29)

FSU settings:
- [**SYSTEM PRESET**]
- [**FREQ** : EXTERNAL MIXER]

Switch off LO with service function:
- [**SETUP** : SERVICE : ENTER PASSWORT **894129**]
- [**SETUP** : SERVICE FUNCTION : **2.18.1.0**]

- [**FREQ** : EXTERNAL MIXER : SELECT BAND]
- Table settings:

Band:	USER
Bias	$\{I_{bias}\}$: - 10 mA, 0 mA, + 10 mA

Test setup:
- Connect the DC current meter between cable conductor and ground of LO_{out} / IF_{in}

Evaluation:
- Read out current

Performance Test Report FSU

Table 1-1 Performance Test report

ROHDE & SCHWARZ	Performance Test Report	FSU	Version 03-07-28
Model (FSU 3/ FSU 8/ FSU 26 / FSU.46):			
Order number:	1166.1660.03 / 1166.1660.08 / 1166.1660.26 / 1166.1660.46:		
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency accuracy Reference oscillator	Page 1.5					
Model w/o Opt. B4		9.999999	_____	10.000001	MHz	
Model with Opt. B4		9.9999997	_____	10.0000003	MHz	
Image frequency rejection,1st IF, f_{in}	Page 1.6					
11 MHz		90	_____	-	dB	
100 MHz		90	_____	-	dB	
1701 MHz		90	_____	-	dB	
3001 MHz		90	_____	-	dB	
Image frequency rejection 2nd IF, f_{in} **f_{in} + 808.8 MHz** ***) f_{in} – 808.8 MH** **FSU**	Page 1.6					
100 MHz		90	_____	-	dB	
FSU 8, FSU 26, 46:						
3700 MHz		70	_____	-	dB	
5000 MHz		70	_____	-	dB	
7999 MHz		70	_____	-	dB	
FSU 26, 46:						
26000 MHz *)		70	_____	-	dB	
FSU 46:						
35000 MHz		70	_____	-	dB	
41000 MHz *)		70	_____	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Image frequency rejection 3rd IF, f_{in}	Page 1.6					
FSU						
100 MHz		90	_____	-	dB	
FSU 8, FSU 26, 46:						
4500 MHz		70	_____	-	dB	
FSU						
2000 MHz		70	_____	-	dB	
1st IF rejection f_{in}	Page 1.7					
11 MHz		90	_____	-	dB	
100 MHz		90	_____	-	dB	
1701 MHz		90	_____	-	dB	
2990 MHz		90	_____	-	dB	
2^{nd} IF rejection f_{in}	Page 1.7					
FSU 3, FSU 8:						
100 MHz		90	_____	-	DB	
FSU 3, FSU 8:						
4500 MHz		70	_____	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd-order intercept point, f_{in}	Page 1.8					
FSU 3, FSU 8:						
28 MHz		17		-	dBm	
106 MHz		17		-	dBm	
261 MHz		17		-	dBm	
640 MHz		20		-	dBm	
1000 MHz		20		-	dBm	
1700 MHz		20		-	dBm	
2500 MHz		20		-	dBm	
3590 MHz		20		-	dBm	
FSU 8:						
4001 MHz		18		-	dBm	
5001 MHz		18		-	dBm	
7999 MHz		18		-	dBm	
FSU 26, 46:						
28 MHz		17		-	dBm	
106 MHz		17		-	dBm	
261 MHz		17		-	dBm	
640 MHz		22		-	dBm	
1000 MHz		22		-	dBm	
1700 MHz		22		-	dBm	
2500 MHz		22		-	dBm	
3590 MHz		22		-	dBm	
4001 MHz		12		-	dBm	
5001 MHz		12		-	dBm	
7999 MHz		12		-	dBm	
12000 MHz		12		-	dBm	
20000 MHz		12		-	dBm	
26000 MHz		12		-	dBm	
FSU 46						
32000 MHz		12		-	dBm	
38000 MHz		12		-	dBm	
2^{nd}-order harmonic distortion, f_{in} :	Page 1.9					
28 MHz		35		-	dBm	
106 MHz		35		-	dBm	
261 MHz		45		-	dBm	
640 MHz		45		-	dBm	
1000 MHz		45		-	dBm	
1700 MHz		35		-	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
IF bandwidth switch. level accuracy	Page 1.10					
100 Hz		-0.1	_____	+0.1	dB	
1 kHz		-0.1	_____	+0.1	dB	
10 kHz		-	reference	-		
100 kHz		-0.1	_____	+0.1	dB	
300 kHz		-0.2	_____	+0.2	dB	
1 MHz		-0.2	_____	+0.2	dB	
3 MHz		-0.2	_____	+0.2	dB	
10 MHz		-0.2	_____	+0.2	dB	
20 MHz		-0.5	_____	+0.5	dB	
FFT Bandwidth level accuracy	Page 1.10					
100 Hz		-0.2	_____	+0.2	dB	
300 Hz		-0.2	_____	+0.2	dB	
1 kHz		-0.2	_____	+0.2	dB	
3 kHz		-0.2	_____	+0.2	dB	
IF bandwidth Bandwidth:	Page 1.11					
100 Hz		97	_____	103	Hz	
1 kHz		970	_____	1030	Hz	
10 kHz		9.7	_____	10.3	kHz	
100 kHz		97	_____	103	kHz	
300 kHz		270	_____	330	kHz	
1 MHz		900	_____	1100	kHz	
3 MHz		2.7	_____	3.3	MHz	
10 MHz		7	_____	11	MHz	
20 MHz		14	_____	22	MHz	
50 MHz		35	_____	55	MHz	
IF Bandwidths Shape factor:	Page 1.11					
100 Hz		-	_____	6	-	
1 kHz		-	_____	6	-	
10 kHz		-	_____	6	-	
100 kHz		-	_____	6	-	
300 kHz		-	_____	12	-	
1 MHz		-	_____	12	-	
3 MHz		-	_____	7	-	
10 MHz		-	_____	7	-	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display f_{noise}:	Page 1.12					
20 Hz		-	_____	-80	dBm	
90 Hz		-	_____	-100	dBm	
900 Hz		-	_____	-110	dBm	
Noise Display normalized to 10Hz: **FSU 3 / 8:**	Page 1.12					
9 kHz		-	_____	-120	dBm	
95 kHz		-	_____	-120	dBm	
999 kHz		-	_____	-130	dBm	
9.99 MHz		-	_____	-145	dBm	
19.99 MHz		-	_____	-145	dBm	
49.99 MHz		-	_____	-145	dBm	
99.99 MHz		-	_____	-145	dBm	
199.9 MHz		-	_____	-145	dBm	
499.9 MHz		-	_____	-145	dBm	
999.9 MHz		-	_____	-145	dBm	
1499 MHz		-	_____	-145	dBm	
1999 MHz		-	_____	-145	dBm	
2499 MHz		-	_____	-143	dBm	
2999 MHz		-	_____	-143	dBm	
3599 MHz		-	_____	-142	dBm	
Noise Display normalized to 10Hz: **FSU 8:**	Page 1.12					
3999 MHz		-	_____	-142	dBm	
4499 MHz		-	_____	-142	dBm	
4999 MHz		-	_____	-142	dBm	
5499 MHz		-	_____	-142	dBm	
5999 MHz		-	_____	-142	dBm	
6499 MHz		-	_____	-142	dBm	
6999 MHz		-	_____	-142	dBm	
7499 MHz		-	_____	-142	dBm	
7999 MHz		-	_____	-142	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 10 Hz:	Page 1.12					
FSU 26, 46:						
9 kHz		-	_____	-120	dBm	
95 kHz		-	_____	-120	dBm	
999 kHz		-	_____	-130	dBm	
9.99 MHz		-	_____	-142	dBm	
19.99 MHz		-	_____	-142	dBm	
49.99 MHz		-	_____	-142	dBm	
99.99 MHz		-	_____	-142	dBm	
199.9 MHz		-	_____	-142	dBm	
499.9 MHz		-	_____	-142	dBm	
999.9 MHz		-	_____	-142	dBm	
1499 MHz		-	_____	-142	dBm	
1999 MHz		-	_____	-142	dBm	
2499 MHz		-	_____	-140	dBm	
2999 MHz		-	_____	-140	dBm	
3599 MHz		-	_____	-140	dBm	
3601 MHz		-	_____	-142	dBm	
6999 MHz		-	_____	-142	dBm	
9999 MHz		-	_____	-140	dBm	
12999 MHz		-	_____	-140	dBm	
17999 MHz		-	_____	-138	dBm	
21999 MHz		-	_____	-137	dBm	
26499 MHz		-	_____	-135	dBm	
FSU 46:						
26799 MHz		-	_____	-132	dBm	
30999 MHz		-	_____	-132	dBm	
34999 MHz		-	_____	-132	dBm	
38999 MHz		-	_____	-130	dBm	
42999 MHz		-	_____	-125	dBm	
45999 MHz		-	_____	-125	dBm	
Level accuracy at 128 MHz. –30 dBm	Page 1.13	-0.2	_____	+0.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF Attenuation 10 dB DC coupling **FSU**	Page 1.13					
f_{fresp}						
1 MHz		-0.5	_____	+0.5	dB	
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
300 MHz		-0.3	_____	+0.3	dB	
400 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
600 MHz		-0.3	_____	+0.3	dB	
700 MHz		-0.3	_____	+0.3	dB	
800 MHz		-0.3	_____	+0.3	dB	
900 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 10 dB DC coupling **FSU 8, FSU 26, 46:**	Page 1.13					
f_{fresp}		-1.5	_____	+1.5	dB	
3610 MHz		-1.5	_____	+1.5	dB	
4000 MHz		-1.5	_____	+1.5	dB	
4500 MHz		-1.5	_____	+1.5	dB	
5000 MHz		-1.5	_____	+1.5	dB	
5500 MHz		-1.5	_____	+1.5	dB	
6000 MHz		-1.5	_____	+1.5	dB	
6500 MHz		-1.5	_____	+1.5	dB	
7000 MHz		-2	_____	+2	dB	
7990 MHz						
FSU 26, 46:		-2	_____	+2	dB	
9000 MHz		-2	_____	+2	dB	
10000 MHz		-2	_____	+2	dB	
11000 MHz		-2	_____	+2	dB	
12000 MHz		-2	_____	+2	dB	
13000 MHz		-2	_____	+2	dB	
14000 MHz		-2	_____	+2	dB	
15000 MHz		-2	_____	+2	dB	
16000 MHz		-2	_____	+2	dB	
17000 MHz		-2	_____	+2	dB	
18000 MHz		-2	_____	+2	dB	
19000 MHz		-2	_____	+2	dB	
20000 MHz		-2	_____	+2	dB	
21000 MHz		-2	_____	+2	dB	
22000 MHz		-2.5	_____	+2.5	dB	
23000 MHz		-2.5	_____	+2.5	dB	
24000 MHz		-2.5	_____	+2.5	dB	
25000 MHz		-2.5	_____	+2.5	dB	
26000 MHz						
FSU 46:					dB	
27000 MHz		-2.5	_____	+2.5	dB	
28000 MHz		-2.5	_____	+2.5	dB	
29000 MHz		-2.5	_____	+2.5	dB	
30000 MHz		-2.5	_____	+2.5	dB	
31000 MHz		-2.5	_____	+2.5	dB	
32000 MHz		-2.5	_____	+2.5	dB	
33000 MHz		-2.5	_____	+2.5	dB	
34000 MHz		-2.5	_____	+2.5	dB	
35000 MHz		-2.5	_____	+2.5	dB	
36000 MHz		-2.5	_____	+2.5	dB	
37000 MHz		-2.5	_____	+2.5	dB	
38000 MHz		-2.5	_____	+2.5	dB	
39000 MHz		-2.5	_____	+2.5	dB	
40000 MHz		-2.5	_____	+2.5	dB	
41000 MHz		-2.5	_____	+2.5	dB	
42000 MHz		-2.5	_____	+2.5	dB	
43000 MHz		-2.5	_____	+2.5	dB	
44000 MHz		-2.5	_____	+2.5	dB	
45000 MHz		-2.5		+2.5		

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 10 dB AC coupling **Not with FSU 46**	Page 1.13					
f_{fresp}						
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	
Frequency response RF attenuation 5 dB DC coupling	Page 1.13					
f_{fresp}						
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 20 dB DC coupling f_{fresp}	Page 1.13					
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	
Frequency response RF attenuation 40 dB DC coupling f_{fresp}	Page 1.13					
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 500 Hz a_{ATT}:	Page 1.16					
10 dB		9.9		10.1	dB	
15 dB		4.9		5.1	dB	
20 dB		-	reference	-	-	
25 dB		-5.1		-4.9	dB	
30 dB		- 10.1		-9.9	dB	
35 dB		-15.1		-14.9	dB	
40 dB		-20.1		-19.9	dB	
45 dB		-25.1		-24.9	dB	
50 dB		-30.1		-29.9	dB	
55 dB		-35.1		-34.9	dB	
60 dB		-40.1		-39.9	dB	
65 dB		-45.1		-44.9	dB	
70 dB		-50.1		-49.9	dB	
75 dB		-55.1		-54.9	dB	
80 dB		-60.1		-59.9	dB	
85 dB		-65.3		-64.7	dB	
90 dB		-70.3		-69.7	dB	
95 dB		-75.3		-74.7	dB	
100 dB		-80.3		-79.7	dB	
Display linearity RBW 300 kHz a_{ATT}:	Page 1.16					
10 dB		9.8		10.2	dB	
15 dB		4.8		5.2	dB	
20 dB		-	reference	-	-	
25 dB		-5.2		-4.8	dB	
30 dB		- 10.2		-9.8	dB	
35 dB		-15.2		-14.8	dB	
40 dB		-20.2		-19.8	dB	
45 dB		-25.2		-24.8	dB	
50 dB		-30.2		-29.8	dB	
55 dB		-35.2		-34.8	dB	
60 dB		-40.2		-39.8	dB	
65 dB		-45.5		-44.5	dB	
70 dB		-50.5		-49.5	dB	
75 dB		-55.5		-54.5	dB	
80 dB		-60.5		-59.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 20 MHz a_{ATT} :	Page 1.16					
10 dB		9.5	_____	10.5	dB	
15 dB		4.5	_____	5.5	dB	
20 dB		-	reference	-	-	
25 dB		-5 5	_____	-4.5	dB	
30 dB		– 10.5	_____	-9.5	dB	
35 dB		-15.5	_____	-14.5	dB	
40 dB		-20.5	_____	-19.5	dB	
45 dB		-25.5	_____	-24.5	dB	
50 dB		-30.5	_____	-29.5	dB	
55 dB		-35.5	_____	-34.5	dB	
60 dB		-40.5	_____	-39.5	dB	
65 dB		-45.5	_____	-44.5	dB	
70 dB		-50.5	_____	-49.5	dB	
Attenuator accuracy a_{ATT} :	Page 1.17					
0 dB		-9.8	_____	-10.2	dB	
5 dB		-4.8	_____	-5.2	dB	
10 dB		-	reference	-	-	
20 dB		+9.8	_____	+10.2	dB	
40 dB		+29.8	_____	+30.2	dB	
Reference level switching accuracy Reference level	Page 1.18					
0 dBm		+9,85	_____	+10,15	dB	
-10 dBm		-	reference	-	-	
-20 dBm		-10.15	_____	-9,85	dB	
-30 dBm		-20.15	_____	-19,85	dB	
-40 dBm		-30.15	_____	-29,85	dB	
-50 dBm		-40.15	_____	-39,85	dB	
-11 dBm		-1.15	_____	-0,85	dB	
-12 dBm		-2.15	_____	-1,85	dB	
-13 dBm		-3.15	_____	-2,85	dB	
-14 dBm		-4.15	_____	-3,85	dB	
-15 dBm		-5.15	_____	-4,85	dB	
-16 dBm		-6.15	_____	-5,85	dB	
-17 dBm		-7.15	_____	-6,85	dB	
-18 dBm		-8.15	_____	-7,85	dB	
-19 dBm		-9.15	_____	-8,85	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Phase noise	Page 1.20					
Offset frequency:						
100 Hz		-		-90	dBc (1Hz)	
1 kHz		-		-112	dBc (1Hz)	
10 kHz		-		-120	dBc (1Hz)	
100 kHz		-		-120	dBc (1Hz)	
1 MHz		-		-138	dBc (1Hz)	
Return Loss	Page 1.22					
RF input						
RF att 10 dB / DC						
f_{in}						
FSU 3, FSU 8:						
10 MHz		14		-	dB	
250 MHz		14		-	dB	
500 MHz		14		-	dB	
750 MHz		14		-	dB	
1000 MHz		14		-	dB	
1250 MHz		14		-	dB	
1500 MHz		14		-	dB	
1750 MHz		14		-	dB	
2000 MHz		14		-	dB	
2250 MHz		14		-	dB	
2500 MHz		14		-	dB	
2750 MHz		14		-	dB	
3000 MHz		14		-	dB	
3250 MHz		14		-	dB	
3500 MHz		14		-	dB	
FSU 8:						
3750 MHz		9,5		-	dB	
4000 MHz		9,5		-	dB	
4250 MHz		9,5		-	dB	
4500 MHz		9,5		-	dB	
4750 MHz		9,5		-	dB	
5000 MHz		9,5		-	dB	
5500 MHz		9,5		-	dB	
6000 MHz		9,5		-	dB	
6500 MHz		9,5		-	dB	
7000 MHz		9,5		-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
FSU 26, 46:						
10 MHz		20	_____	-	dB	
250 MHz		20	_____	-	dB	
500 MHz		20	_____	-	dB	
750 MHz		20	_____	-	dB	
1000 MHz		20	_____	-	dB	
1250 MHz		20	_____	-	dB	
1500 MHz		20	_____	-	dB	
1750 MHz		20	_____	-	dB	
2000 MHz		20	_____	-	dB	
2250 MHz		20	_____	-	dB	
2500 MHz		20	_____	-	dB	
2750 MHz		20	_____	-	dB	
3000 MHz		20	_____	-	dB	
3250 MHz		20	_____	-	dB	
3500 MHz		20	_____	-	dB	
4000 MHz		14	_____	-	dB	
6000 MHz		14	_____	-	dB	
8000 MHz		14	_____	-	dB	
10000 MHz		14	_____	-	dB	
12000 MHz		14	_____	-	dB	
14000 MHz		14	_____	-	dB	
16000 MHz		14	_____	-	dB	
18000 MHz		9,5	_____	-	dB	
20000 MHz		9,5	_____	-	dB	
22000 MHz		9,5	_____	-	dB	
24000 MHz		9,5	_____	-	dB	
26000 MHz		9,5	_____	-	dB	
FSU 46						
28000 MHz		7,5	_____	-	dB	
30000 MHz		7,5	_____	-	dB	
32000 MHz		7,5	_____	-	dB	
34000 MHz		7,5	_____	-	dB	
36000 MHz		7,5	_____	-	dB	
38000 MHz		7,5	_____	-	dB	
40000 MHz		7,5	_____	-	dB	

Performance Test Report Option FSU-B9

Table 1-2: Performance Test Report Option B9, B12

ROHDE & SCHWARZ	Performance Test Report	Option B9	Version 28.07.03
Serial number:			
Option B12 installed: yes / no			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy of the output level at 128 MHz:	Page 1.24					
Without option B12						
0 dBm		- 1		+ 1	dBm	
- 5 dBm		- 6		- 4	dBm	
-10 dBm		- 11		- 9	dBm	
-15 dBm		- 16		- 14	dBm	
-20 dBm		– 21		- 19	dBm	
With option B12						
0 dBm		– 1		+ 1	dBm	
-10 dBm		– 11		– 9	dBm	
-20 dBm		– 21		– 19	dBm	
-40 dBm		– 41		– 39	dBm	
Frequency response Tracking generator 100 kHz to 3.6 GHz output level, referenced to 128 MHz:	Page 1.25					
Without option B12						
0 dBm		- 3		+ 3	dB	
- 5 dBm		– 3		+ 3	dB	
– 10 dBm		– 3		+ 3	dB	
– 15 dBm		– 3		+ 3	dB	
– 20 dBm		– 3		+ 3	dB	
With option B12						
0 dBm		- 4		+ 4	dB	
-10 dBm		– 4		+ 4	dB	
-20 dBm		– 4		+ 4	dB	
-40 dBm		– 4		+ 4	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Dynamic range Tracking generator at 128 MHz: reference level isolation	Page 1.27	 - 1 -	 _____ _____	 + 1 - 100	 dBm dBc	
Checking modulation Tracking generator I/Q modulation +90 ° output level: Signal 1001 MHz residual carrier sideband 999 MHz I/Q modulation -90 ° output level: Signal 999 MHz residual carrier sideband 1001 MHz	Page 1.26	 - 3 - - - 3 - -	 _____ _____ _____ _____ _____ _____	 + 3 - 30 - 30 + 3 - 30 - 30	 dBm dBc dBc dBm dBc dBc	
Checking Modulation Tracking generator AM modulation Carrier level Sgnl spacing 1001 MHz Signal spacing 999 MHz	Page 1.26	 - 3 - 8 - 8	 _____ _____ _____	 + 3 - 4 - 4	 dBm dBc dBc	
Checking modulation Tracking generator FM modulation Carrier level Sgnl spcng 1000.1 MHz Sgnl spcng 999.9 MHz	Page 1.27	 - 5 - 5 - 5	 _____ _____ _____	 + 1 - 3 - 3	 dBm dBc dBc	

Performance Test Report Option B25

Table 1-3: Performance Test Report Option B25

ROHDE & SCHWARZ	Performance Test Report	Option B25	Version 03-07-28
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display with Preamplifier (B25) **FSU**: f_{noise}:	Page 1.28					
10.99 MHz		-	_____	-152	dBm	
19.99 MHz		-	_____	-152	dBm	
49.99 MHz		-	_____	-152	dBm	
99.99 MHz		-	_____	-152	dBm	
199.9 MHz		-	_____	-152	dBm	
499.9 MHz		-	_____	-152	dBm	
999.9 MHz		-	_____	-152	dBm	
1499 MHz		-	_____	-152	dBm	
1999 MHz		-	_____	-152	dBm	
2499 MHz		-	_____	-150	dBm	
2999 MHz		-	_____	-150	dBm	
3599 MHz		-	_____	-150	dBm	
Noise Display with Preamplifier (B25) **FSU 8:** f_{noise}	Page 1.28					
3601 MHz		-	_____	-147	dBm	
3999 MHz		-	_____	-147	dBm	
4499 MHz		-	_____	-147	dBm	
4999 MHz		-	_____	-147	dBm	
5499 MHz		-	_____	-147	dBm	
5999 MHz		-	_____	-147	dBm	
6499 MHz		-	_____	-147	dBm	
6999 MHz		-	_____	-147	dBm	
7999 MHz		-	_____	-147	dBm	
Level accuracy with Preamplifier (B25) at 128 MHz, -30 dBm	Page 1.29	-0.3	_____	+0.3	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with preamplifier (B25) **FSU:** f_{fresp}	Page 1.29					
10 MHz		-1	_____	+1	dB	
50 MHz		-0.6	_____	+0.6	dB	
100 MHz		-0.6	_____	+0.6	dB	
200 MHz		-0.6	_____	+0.6	dB	
300 MHz		-0.6	_____	+0.6	dB	
400 MHz		-0.6	_____	-0.6	dB	
500 MHz		-0.6	_____	+0.6	dB	
600 MHz		-0.6	_____	+0.6	dB	
700 MHz		-0.6	_____	+0.6	dB	
800 MHz		-0.6	_____	+0.6	dB	
900 MHz		-0.6	_____	+0.6	dB	
1000 MHz		-0.6	_____	+0.6	dB	
1500 MHz		-0.6	_____	+0.6	dB	
2000 MHz		-0.6	_____	+0.6	dB	
2500 MHz		-0.6	_____	+0.6	dB	
2990 MHz		-0.6	_____	+0.6	dB	
3590 MHz		-0.6	_____	+0.6	dB	
Frequency Response with preamplifier (B25) **FSU 8:** f_{fresp}	Page 1.29					
3610 MHz		-2	_____	+2	dB	
4000 MHz		-2	_____	+2	dB	
4500 MHz		-2	_____	+2	dB	
5000 MHz		-2	_____	+2	dB	
5500 MHz		-2	_____	+2	dB	
6000 MHz		-2	_____	+2	dB	
6500 MHz		-2	_____	+2	dB	
6990 MHz		-2	_____	+2	dB	
7990 MHz		-2	_____	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 1.32					
E_{ATT} = 5 dB						
FSU: f_{fresp}						
10 MHz		-1		+1	dB	
50 MHz		-0.6		+0.6	dB	
100 MHz		-0.6		+0.6	dB	
200 MHz		-0.6		+0.6	dB	
300 MHz		-0.6		+0.6	dB	
400 MHz		-0.6		+0.6	dB	
500 MHz		-0.6		+0.6	dB	
600 MHz		-0.6		+0.6	dB	
700 MHz		-0.6		+0.6	dB	
800 MHz		-0.6		+0.6	dB	
900 MHz		-0.6		+0.6	dB	
1000 MHz		-0.6		+0.6	dB	
1500 MHz		-0.6		+0.6	dB	
2000 MHz		-0.6		+0.6	dB	
2500 MHz		-0.6		+0.6	dB	
2990 MHz		-0.6		+0.6	dB	
3590 MHz		-0.6		+0.6	dB	
Frequency Response elec. attenuator (B25)	Page 1.32					
E_{ATT} = 5 dB						
FSU 8: f_{fresp}						
3610 MHz		-2		+2	dB	
4000 MHz		-2		+2	dB	
4500 MHz		-2		+2	dB	
5000 MHz		-2		+2	dB	
5500 MHz		-2		+2	dB	
6000 MHz		-2		+2	dB	
6500 MHz		-2		+2	dB	
6990 MHz		-2		+2	dB	
7990 MHz		-2		+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 1.32					
E_{ATT} = 10 dB						
FSU: f_{fresp}						
10 MHz		-1		+1	dB	
50 MHz		-0.6		+0.6	dB	
100 MHz		-0.6		+0.6	dB	
200 MHz		-0.6		+0.6	dB	
300 MHz		-0.6		+0.6	dB	
400 MHz		-0.6		+0.6	dB	
500 MHz		-0.6		+0.6	dB	
600 MHz		-0.6		+0.6	dB	
700 MHz		-0.6		+0.6	dB	
800 MHz		-0.6		+0.6	dB	
900 MHz		-0.6		+0.6	dB	
1000 MHz		-0.6		+0.6	dB	
1500 MHz		-0.6		+0.6	dB	
2000 MHz		-0.6		+0.6	dB	
2500 MHz		-0.6		+0.6	dB	
2990 MHz		-0.6		+0.6	dB	
3590 MHz		-0.6		+0.6	dB	
Frequency Response elec. attenuator (B25)	Page 1.32					
E_{ATT} = 10 dB						
FSU 8: f_{fresp}						
3610 MHz		-2		+2	dB	
4000 MHz		-2		+2	dB	
4500 MHz		-2		+2	dB	
5000 MHz		-2		+2	dB	
5500 MHz		-2		+2	dB	
6000 MHz		-2		+2	dB	
6500 MHz		-2		+2	dB	
6990 MHz		-2		+2	dB	
7990 MHz		-2		+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 1.32					
E_{ATT} = 15 dB						
FSU: f_{fresp}						
10 MHz		-1		+1	dB	
50 MHz		-0.6		+0.6	dB	
100 MHz		-0.6		+0.6	dB	
200 MHz		-0.6		+0.6	dB	
300 MHz		-0.6		+0.6	dB	
400 MHz		-0.6		+0.6	dB	
500 MHz		-0.6		+0.6	dB	
600 MHz		-0.6		+0.6	dB	
700 MHz		-0.6		+0.6	dB	
800 MHz		-0.6		+0.6	dB	
900 MHz		-0.6		+0.6	dB	
1000 MHz		-0.6		+0.6	dB	
1500 MHz		-0.6		+0.6	dB	
2000 MHz		-0.6		+0.6	dB	
2500 MHz		-0.6		+0.6	dB	
2990 MHz		-0.6		+0.6	dB	
3590 MHz		-0.6		+0.6	dB	
Frequency Response elec. attenuator (B25)	Page 1.32					
E_{ATT} = 15 dB						
FSU 8: f_{fresp}						
3610 MHz		-2		+2	dB	
4000 MHz		-2		+2	dB	
4500 MHz		-2		+2	dB	
5000 MHz		-2		+2	dB	
5500 MHz		-2		+2	dB	
6000 MHz		-2		+2	dB	
6500 MHz		-2		+2	dB	
6990 MHz		-2		+2	dB	
7990 MHz		-2		+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd-order intercept point with elec. att., f_{in}	Page 1.34					
FSU:						
28 MHz		17	_____	-	dBm	
106 MHz		17	_____	-	dBm	
261 MHz		17	_____	-	dBm	
640 MHz		20	_____	-	dBm	
1000 MHz		20	_____	-	dBm	
1700 MHz		20	_____	-	dBm	
2500 MHz		20	_____	-	dBm	
3590 MHz		20	_____	-	dBm	
FSU 8:						
3610 MHz		18	_____	-	dBm	
5000 MHz		18	_____	-	dBm	
7990 MHz		18	_____	-	dBm	
Attenuator accuracy, a_{ATT} :	Page 1.35					
0 dB		-9.8	_____	-10.2	dB	
5 dB		-4.8	_____	-5.2	dB	
10 dB		-	reference	-	-	
15 dB		+4.8	_____	+5.2	dB	
20 dB		+9.8	_____	+10.2	dB	
25 dB		+14.8	_____	+15.2	dB	
30 dB		+19.8	_____	+20.2	dB	
35 dB		+24.8	_____	+25.2	dB	
40 dB		+29.8	_____	+30.2	dB	
45 dB		+34.8	_____	+35.2	dB	
50 dB		+39.8	_____	+40.2	dB	
55 dB		+44.8	_____	+45.2	dB	
60 dB		+49.8	_____	+50.2	dB	
65 dB		+54.8	_____	+55.2	dB	
70 dB		+59.8	_____	+60.2	dB	
75 dB		+64.8	_____	+65.2	dB	
Electronic Attenuator accuracy ., a_{ATT}	Page 1.36					
0 dB		-0.2	_____	+0.2	dB	
5 dB		+4.8	_____	+5.2	dB	
10 dB		+9.8	_____	+10.2	dB	
15 dB		+14.8	_____	+15.2	dB	
20 dB		+19.8	_____	+20.2	dB	
25 dB		+24.8	_____	+25.2	dB	
30 dB		+29.8	_____	+30.2	dB	

Performance Test Report Option FSU-B21

Table 1-5: Performance Test Report Option B21

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
LO-level	page 4.1					
fc						
140,5 GHz		14		16	dBm	
150,5 GHz		14		16	dBm	
160,5 GHz		14		16	dBm	
170,5 GHz		14		16	dBm	
180,5 GHz		14		16	dBm	
190,5 GHz		14		16	dBm	
200,5 GHz		14		16	dBm	
210,5 GHz		14		16	dBm	
220,5 GHz		14		16	dBm	
230,5 GHz		14		16	dBm	
240,5 GHz		14		16	dBm	
250,5 GHz		14		16	dBm	
260,5 GHz		14		16	dBm	
270,5 GHz		14		16	dBm	
280,5 GHz		14		16	dBm	
290,5 GHz		14		16	dBm	
300,5 GHz		14		16	dBm	
309,5 GHz		14		16	dBm	
level display 2-port-mixer	4.2	- 1		+ 1	dBm	
level display 3-port-mixer	4.3	- 1		+ 1	dBm	
bias currency	4.4	- 12,0		- 8,0	mA	
		- 1,0		+ 1,0	mA	
		+ 8,0		+ 12,0	mA	

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2 Adjustment

This chapter describes the adjustment of the reference sources as well as the software-controlled adjustment of individual module data following module replacement.

The R&S FSU permits the following manual adjustments:

- Adjustment of the 10 MHz reference oscillator which determines the frequency accuracy of the R&S FSU
- Adjustment of the 128 MHz calibration source which determines the level accuracy of the R&S FSU

The adjustment permits the data integrity of the instrument to be maintained and restored.

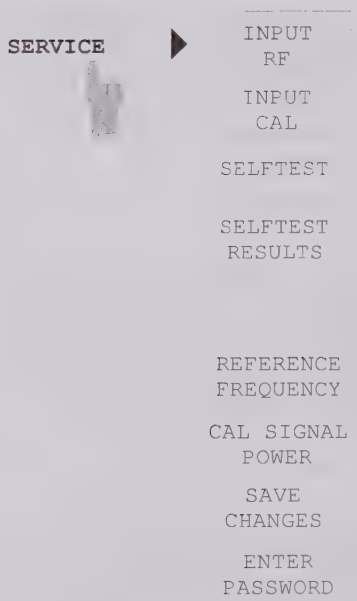
Manual adjustments must be performed at an ambient temperature of between +20 °C and +30 °C after the instrument has warmed up.

After the adjustment and an internal total calibration has been performed, the R&S FSU is ready for use and offers full data integrity.

Service Menu

The service functions for adjusting the boards are only usable after the entry of a password to prevent impairment of instrument functionality by unintended data changes.

SETUP menu:



The *SERVICE* softkey opens a submenu for selecting the service function

Entering Password

SETUP SERVICE submenu:

ENTER PASSWORD

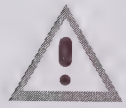
The *ENTER PASSWORD* softkey allows the entry of a password.

The R&S FSU contains a variety of service functions which, if incorrectly used, can impair the functionality of the analyzer. These functions are normally not accessible and are only usable after the entry of a password.

The password permits data to be changed that is required in order to calibrate or repair the instrument (for example, reference frequency adjustment, level adjustment, general board data). The password is "894129".

IEC/IEEE-bus command: `SYST:PASS "<Password>"`

Adjustment Functions



Caution:

The realignment should be carried out by qualified personnel since any change considerably influences the measurement accuracy of the instrument. This is the reason why the softkeys REF FREQUENCY, CAL SIGNAL POWER and SAVE CHANGES can only be accessed after entering a password.

SETUP SERVICE submenu:

REF FREQUENCY

The *REF FREQUENCY* softkey opens the data input for the adjustment of the reference frequency. Values can be selected between 0 and 255 (without option R&S FSU-B4 OCXO) or between 0 to 4095 (with option R&S FSU-B4 OXCO). They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store the setting permanently in nonvolatile memory.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN 155`

CAL SIGNAL POWER

The *CAL SIGNAL POWER* softkey opens the data input for the adjustment of the currently set level of the calibration signal (0 dBm or -30 dBm, compare *INPUT CAL* softkey). Values can be selected between 0 and 255. They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store the setting permanently in nonvolatile memory.

IEC/IEEE-bus command: --

SAVE CHANGES

The *SAVE CHANGES* softkey stores the modifications in the nonvolatile memory of the instrument. Since these modifications considerably influence the measurement accuracy of the instrument, confirmation by the user is requested before storing.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN:SAV`

Manual Adjustment

This section explains the measuring instruments and auxiliary means required when manually adjusting the R&S FSU, the appropriate preparations of the instrument as well as the individual adjustments.

Test Instructions

- The adjustment of the analyzer must be done after a warm-up time of at least 30 minutes and overall calibration. Only in this case can compliance with the guaranteed data be ensured.
- Inputs for setting the R&S FSU during measurements are shown as following:

  [**<KEY>**] Press a key on the front panel, e.g. **[SPAN]**

  [<SOFTKEY>] Press a softkey, e.g. [MARKER -> PEAK]

  [<**nn unit**>] Enter a value and terminate by entering the unit, e.g. [**12 kHz**]

  Successive entries are separated by [:], e.g. [**BW** : RES BW MANUAL : **3 kHz**]

Measuring Equipment and Accessories

Table 2-1 Measuring equipment and accessories for manually adjusting the FSU

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	error < $1x10^{-9}$, frequency range up to 10 MHz	Advantest R5361B with option 23		Frequency Accuracy of Reference Oscillator
2	Signal generator	frequency range to 1 GHz: output level -10 dBm	SMHU	0835.8011.52	Calibration Source 128 MHz Frequency Accuracy of Reference Oscillator
3	Power meter		NRVD	0857.8008.02	Calibration Source 128 MHz
4	Power sensor	1 MHz to 3 GHz RSS ≤ 0.8% meter noise ≤ 20 pW	NRV-Z4	0828.3618.02	Calibration Source 128 MHz

Adjusting Level Measurement Accuracy

Test equipment:

- Signal generator (Section "Measuring Equipment", item 2):
  frequency 128 MHz
  level -30 dBm
- Power meter (Section "Measuring Equipment", item 3)
- Power sensor (Section "Measuring Equipment", item 4)
  frequency 128 MHz
  maximum power $P_{max} \geq 1$ µW
  meter noise ≤ 20 pW
  RSS ≤ 0.8% referred to indicated power
  impedance Z = 50 Ω

Power meter settings:

➢ Connect power sensor to power meter and carry out function ´ZERO´ when no signal is applied to the power sensor.

➢ Connect power sensor to RF output of signal generator.

Signal generator settings:

- Frequency 128 MHz
- Level –30 dBm ± 0.05 dB

➢ Use power meter for exact level adjustment.

Test setup:

➢ Connect RF output of the signal generator to RF input of the R&S FSU.

Overall calibration of the R&S FSU:

- [**PRESET**]
- [**CAL** : CAL TOTAL]

R&S FSU settings:

- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **15 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**BW** : VID BW MANUAL : **1 kHz**]
- [**TRACE** : DETEKTOR : RMS]
- [**AMPT** : REF LEVEL : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]

Reference measurement

➢ Set marker to peak of signal
- [**MKR SEARCH** : PEAK]

➢ Set reference to peak of signal
- - [**MKR** : REFERENCE FIXED]

➢ Switch internal reference generator to RF input
- [**SETUP** : SERVICE : INPUT CAL]

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Adjustment:

The reading ´Delta [T1 FXD]´ displays the difference between the output level of the signal generator and the level of the calibration source.

Caution:

The following realignment changes the level of the internal calibration source. Since this adjustment influences the level measurement accuracy of the R&S FSU, it is strongly recommended that this adjustment be performed only if the level is not within the tolerance. .

R&S FSU settings:

- [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**]
- [**SETUP :** SERVICE : CAL SIGNAL POWER]

➢ The correction value for the calibration signal level will be displayed in the data entry field. Change the value with the step keys or spin wheel until the marker reading ´Delta [T1 FXD]´ displays a value of 0 ± 0,05 dB.

Store value in instrument

- [**SETUP :** SERVICE : SAVE CHANGES]

➢ Confirm message on display with ´YES´ . The correction values will be stored in non-volatile memory on the boards.

Note:

The changed level of the calibration source will be used with the following total calibration.

- [**CAL :** TOTAL CALIBRATION]
- [**CAL :** CALIBRATION RESULTS]

➢ Check the calibration results. The calibration must be performed with the status ´PASSED`.

Adjusting Frequency Accuracy

Preparation: The measurement can be performed either with a signal generator at connector RF INPUT (front of the R&S FSU) at 1 GHz or at connector EXT REF OUT (rear of the R&S FSU) at 10 MHz using a frequency counter.
To be adjusted, the R&S FSU must be set to internal reference.

Note: *The measurement at 1 GHz can be performed with a lower frequency counter resolution in order to achieve faster adjustment.*

Preparations for adjustment with signal generator:

Test equipment:

- Signal generator (Section "Measuring Equipment", item 2):
  frequency 1000 MHz
  level -20 dBm
  frequency accuracy $<1x10^{-9}$

If the frequency accuracy of the signal generator is not sufficient, adjust the frequency with a frequency counter to the correct frequency before the adjustment.

Test setup:

➢ Connect the RF output of the signal generator to RF input of the R&S FSU.

R&S FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **1 GHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **1 MHz**]
- [**AMPT** : REF LEVEL : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SETUP** : REFERENCE INT / EXT]

➢ Toggle to internal reference (INT)

Note: *Before the following measurement, the FSU must warm up for at least 30 minutes to heat the reference oscillator.*

Measurement:

➢ Switch on marker frequency counting:
- [**MKR** : SIGNAL COUNT]

➢ Set the necessary resolution:

Model without OCXO (Option B4) 1 GHz ± 1 kHz
- [**MKR** : **NEXT** : CNT RESOL 100 HZ]

Model with OCXO (Option B4) 1 GHz ± 100 Hz
- [**MKR** : **NEXT**: CNT RESOL 10 HZ]

Preparation for adjustment with frequency counter:

Test equipment:

Frequency counter (Section "Measuring Equipment", item 1):
error < $1x10^{-9}$
frequency range up to 10 MHz

Test setup:

➢ Connect frequency counter to 10 MHz reference output of the R&S FSU (rear panel).

R&S FSU settings:

- [**SETUP** : REFERENCE INT / EXT]
➢ Toggle to internal reference (INT).

Frequency counter settings:

➢ Set the necessary resolution:
model without OCXO (option B4): 1 Hz
model with OCXO (option B4): 0.1 Hz

Note:

Before the following measurement, the R&S FSU must warm up at least 30 minutes to heat the reference oscillator.

Measurement:

➢ Measure frequency with frequency counter:

Nominal frequency:
model without OCXO (option R&S FSU-B4) ..... 10 MHz ± 10 Hz
model with OCXO (option R&S FSU-B4) ..... 10 MHz ± 1 Hz

Adjustment:

Important Note !

The following adjustment changes the frequency of the internal reference source. Since this adjustment influences the frequency accuracy of the R&S FSU, *it is strongly recommended that this adjustment be performed only if the frequency is not within the tolerance.*

R&S FSU settings:

- [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**]
- [**SETUP :** SERVICE : REF FREQUENCY]

➢ The correction value for the reference frequency adjustment will be displayed in the data entry field. Change the value with the step keys or spin wheel until the frequency counter reading or the marker count reading displays a value within the tolerance.

Store value in instrument

- [**SETUP :** SERVICE : SAVE CHANGES]

➢ Confirm message on display with ´YES´ . The correction values will be stored in non-volatile memory on the boards.

Adjustment of Module Data

All boards of the R&S FSU contain EEPROMS for storing board data.
In addition to some standard information such as module name, serial number, hardware status and date of manufacture, these stored data items contain important pieces of information within value tables from module pre-testing, e.g. frequency responses for module error data. When a cold start is performed, this EEPROM data is read out and stored on hard disk. During normal operation, the data set stored on hard disk is always used.

In order to synchronize the data stored in EEPROMs on the respective modules with the complete instrument, a cold start must be performed after each module replacement so that the module data will be updated.

The complete contents of the new module are read from the EERPOM and copied to the hard disk of the R&S FSU. The existing calibration data (results from the latest total calibration) are deleted and the instruments displays UNCAL. Thus, the R&S FSU must always be calibrated again after a module is replaced (softkey *CAL TOTAL*).
After a full calibration has been completed successfully, a backup of the EEPROM files to hard disk must be performed using a service function.

Settings on the R&S FSU: - [**SETUP :** SERVICE : ENTER PASSWORD : **30473035 ENTER**]
- [**SETUP :** SERVICE : SERVICE FUNCTION : **3.0.11 ENTER**]

If the IF filter module has been replaced, the calibration data should also be copied back to the EEPROM:

Settings on the R&S FSU: - [**SETUP :** SERVICE : SERVICE FUNCTION : **3.0.7 ENTER**]

If an option module is removed from an instrument (downgrade), the EEPROM file associated with the module as well as any ".bak" file(s) present under path D:\r_s\instr\eeprom\ and C:\r_s\instr\eeprom\backup must be deleted.

Frequency Response Correction

With some boards (see chapter 3, section "Module Replacement"), frequency response correction is necessary in addition to the automatic adjustment of module data. This correction is performed by means of software. The program is available on the GLORIS server.
For information on when to perform the frequency response correction, see chapter 3, section "Module Replacement".

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3 Repair

This chapter describes the design of the R&S FSU, simple measures for repair and troubleshooting and the replacement of modules. For troubleshooting and diagnostics, a selftest is available that can be used to poll diagnostic voltages of the modules and signal limit violations.

The firmware update and the installation of options are described in chapter 4 of this service manual.

Instrument Design and Function Description

A detailed schematic of the R&S FSU design is presented in the block diagrams below and in the exploded views (see also chapter 5).
The following description of instrument functions refers to the block diagram.

Block Diagram

See also chapter 5 illustrations for a detailed block diagram.

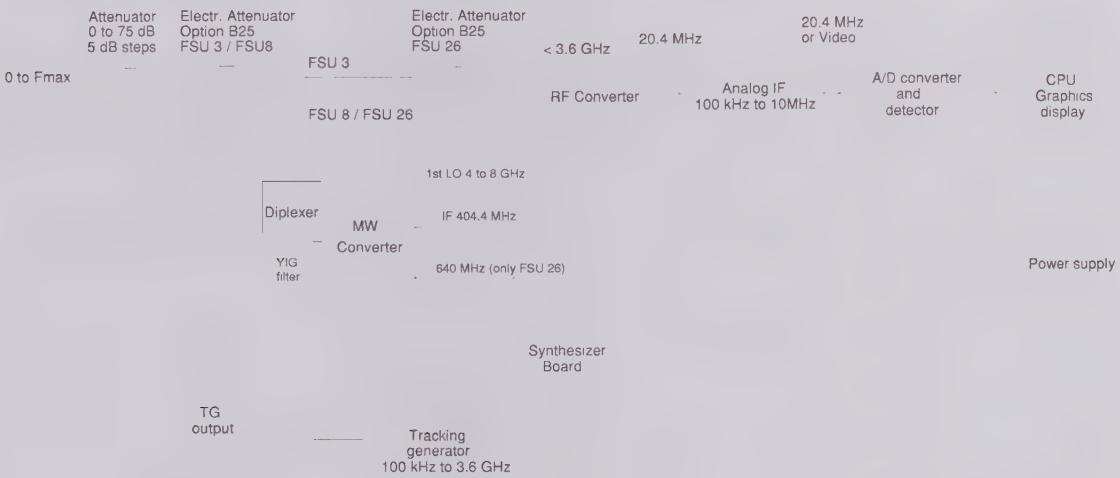


Fig. 3-1 Block diagram of instrument

Description of Block Diagram

The R&S FSU is a triple-conversion superhet receiver (double-conversion for receive frequencies >3.6 GHz) for the frequency range 20 Hz to 3.6 GHz, 8 GHz, 26,5 or 46 GHz (depending on the instrument model). The signals are processed by one RF board (two for models > 3.6 GHz), one IF board, one signal detection board and a controller consisting of a Pentium industry PC, an I/O interface and a graphics controller. The instrument can be upgraded to meet future requirements by retrofitting options in the analog and digital sections.

The input signal is reduced in level by the attenuator and routed to the RF modules depending on the instrument type. In instruments with option R&S FSU-B25 (electronic attenuator), this module follows in the signal path. In 3.6 GHz models, the attenuator is followed by the RF converter; in the high-frequency models, a diplexer is connected in between. The high-frequency signal component >3.6 GHz is routed to the microwave converter module following the diplexer. The IF module is the same in all instrument models, and likewise for the signal path through signal detection to the display.

The internal reference and calibration signals are generated in the frequency and level reference part on the synthesizer board. Here the 128 MHz reference frequency is generated and made available to the instrument as a reference frequency, and a level-controlled output signal is generated as an internal level reference for instrument calibration.

A detailed description of the modules is given in the following.

Attenuator

The RF signal passes from the input connector via the input switch to the attenuator, which can be set. The input signal is applied to the switch as well as a 128 MHz signal, which has a close-tolerance level of -30 dBm for calibration purposes or 0 dBm for the selftest of the instrument. Different attenuators are used: the 8 GHz attenuator in the R&S FSU3 and R&S FSU8, and the microwave attenuators up to 26 GHz or 46 GHz. All attenuators switch in steps of 5 dB and have maximum total attenuation of 75 dB; the 8 and 26 GHz attenuators contain an AC coupling that can be bypassed. The lower limit frequency of AC coupling is 1 MHz with the 8 GHz attenuator and < 10 MHz with the attenuator in the R&S FSU26; models > 26 GHz are permanently DC-coupled.

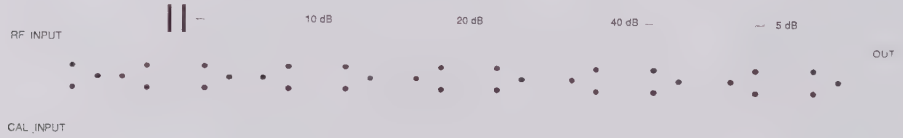


Fig. 3-2 Input attenuator

Electronic Attenuator (Option R&S FSU-B25)

The electronic attenuator is inserted in the signal path after the attenuator. It consists of a mechanical 5 dB attenuator pad, an electronic input attenuator, which can be switched from 0 to 30 dB in steps of 5 dB, and a switchable 20 dB preamplifier to reduce the noise figure of the R&S FSU.

RF to IF Conversion for Frequencies < 3.6 GHz – RF Converter

The RF converter is used to convert the signal in the reception range from 20 Hz to 3.6 GHz to a low intermediate frequency of 20.4 MHz.
The balanced input mixer first converts the input signal to an intermediate frequency of approx. 4.63 GHz. The symmetric design reduces second-order intermodulation.

The first local oscillator in the frequency range 4.63 to 8.23 GHz is implemented with a YIG-tuned oscillator. This oscillator is synchronized via several dividers to the signal from the synthesizer module (600 to 620 MHz). The balanced output of the first mixer is amplified with two bipolar transistors to prevent 1/f noise. This balanced signal is fed to a three-stage filter with dielectric resonators. Flatness and group delay of the filter are optimized for broadband vector analysis in a bandwidth of 30 MHz. The filter feeds a second mixer, which converts the signal to the second IF of 404.4 MHz. The balanced output is amplified with two amplifiers to reduce intermodulation products. The output signals from the two amplifiers are combined in a transformer to form an unbalanced signal. Due to the symmetric design, there is no need for transformers in the mixers so that the conversion loss is reduced.

The second IF can be filtered to a bandwidth of 10 or 20 MHz using two five-stage filters with ceramic resonators. A bypass for a 50 MHz bandwidth (= 3 dB bandwidth of the first IF filter) can be selected also. The signal is fed to the third mixer via an attenuator pad that can be switched in steps of 1 dB. With 30 MHz FFT span, the K2 of the 3rd mixer causes spurious noise within the band. Therefore, the level has to be reduced before this mixer stage if high input levels are used (> -25 dBm). The attenuator can also be used to drive the input mixer up to +10 dBm, thus allowing a better dynamic range in phase noise or spurious measurements with a large carrier offset (> 1 MHz).

Fast overload detectors are used to detect compression in the stages of the first and second intermediate frequencies. The bandwidth of these detectors is above 100 MHz so that pulse signals can be detected as well with a preselector of the same width. The output signal of the detector on the second IF is also used with a logarithmic amplifier as an RF power trigger with a dynamic range of 70 dB.

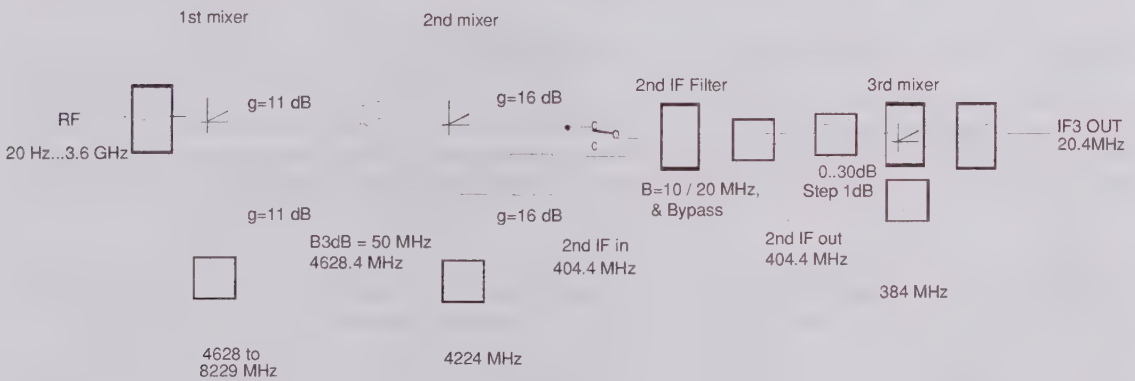


Fig. 3-3 Conversion of the RF to the third IF from 20 Hz to 3.6 GHz

RF to IF Conversion for Frequencies > 3.6 GHz - MW Converter

The high-frequency models of the R&S (frequency range > 3.6 GHz) also comprise a microwave converter board. After the RF attenuator, the input signals are fed to the microwave converter and split up in the diplexer to frequencies below 3.6 GHz and above 3.6 GHz. Signals below 3.6 GHz are forwarded to the RF converter like in the R&S . Signals above 3.6 GHz are taken via the YIG filter to the mixer, where they are directly converted to the 2nd IF of 404.4 MHz. In the range >26 GHz, the signals are converted to the 404.4 MHz IF in two stages. The YIG filter can be bypassed by means of a relay.

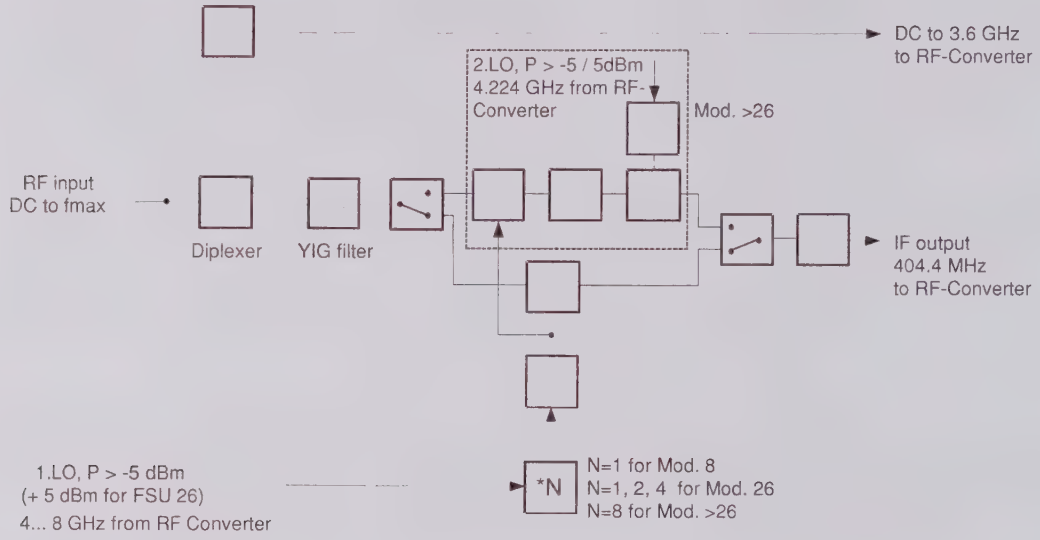


Fig. 3-4 Conversion of the RF to the IF from 3.6 GHz

The first LO converts the input frequency to the 404.4 MHz IF. For this purpose, the LO signal (4 GHz to 8 GHz) generated in the RF converter is amplified to the required LO level. The R&S FSU26 has two additional doubler stages that can be bypassed and generate the LO signal for conversion to 26.5 GHz. Models >26 GHz have an additional doubler stage. The eight-way LO converts the signals to an initial IF of 3819.6 MHz or 4628.4 MHz. The second LO then converts the signal to the 404.4 MHz IF.

The basic model is equipped with the necessary interfaces (IF input 404.4 MHz, LO output 4 to 7.6 GHz) for extending the frequency range by simply adding a microwave converter.

IF Filter Module

The RF converter is followed by the analog IF filter module:

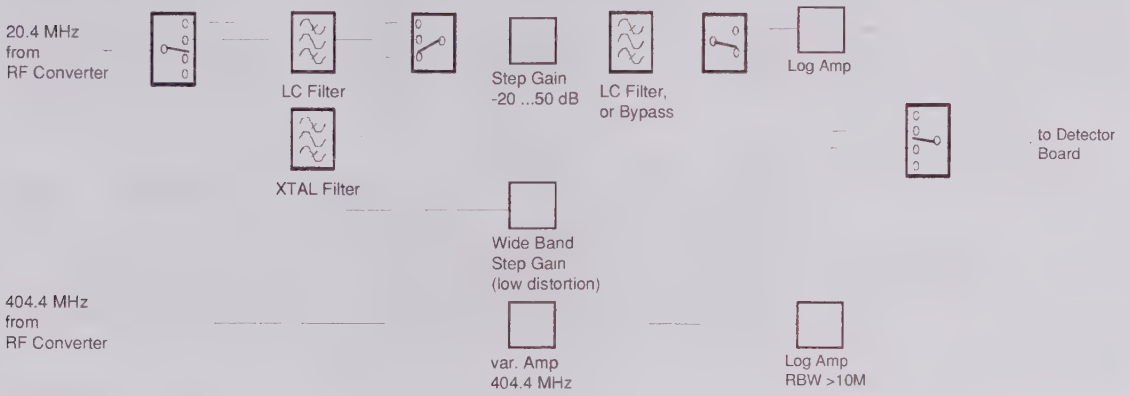


Fig. 3-5 IF filter

The R&S FSU offers resolution bandwidths from 1 Hz to 20 MHz in steps of 1/2/3/5. For the bandwidths above 5 MHz, the selection filter is provided in the RF converter. There is no selection at the 20.4 IF; a logarithmic amplification to 404.4 MHz is performed.
The tunable bandwidths 100 kHz to 5 MHz are at the 3rd IF (20.4 MHz) on the IF filter module. The bandwidths 100 kHz to 5 MHz are provided by 5 LC circuits.
The step gain can be set from -20 to 50 dB in 0.1 dB steps and is adjusted as a function of the reference level and the input attenuation.
The IF filters are followed by a log detector to obtain the dynamic range of the display.
A limiting amplifier in the log amp provides the TTL output for the frequency counter.

With a 10 bandwidth, the LC filters are bypassed; however, step gain and log amp are used as with the analog bandwidths between 200 kHz and 5 MHz.
For the digital resolution filters from 10 Hz to 100 kHz, the 20.4 MHz IF signal at the IF filter output is routed to the A/D converter. With bandwidths below or equal to 30 kHz, a two-stage crystal filter is used to prevent the step gain and the ADC from being overdriven. This filter can be tuned from about 2.5 to 70 kHz in bandwidth. With the bandwidths 50 kHz and 100 kHz, the LC filter is set to about 400 kHz for the same reason.

An additional path without any filtering is used for the broadband vector analysis. The step gain is optimized for low distortion; as with a bandwidth of 30 MHz at a center frequency of 20.4 MHz, the harmonics of the IF are also present at the input of the ADC.

The R&S FSU contains an AM/FM demodulator on the IF filter. In the spectrum analysis mode, the signal applied at the position of the reference marker can be demodulated during the sweep. For this purpose, the R&S FSU stops the frequency sweep for a selectable period of time and demodulates the input signal. The volume is set using the spinwheel on the front panel (AF OUTPUT). The demodulator bandwidth corresponds to that of the input filter in the case of digital filters. To ensure good reception, the 30-kHz filter should be used, with the filter preceding the demodulator being at approx. 70 kHz.

Processing of Measured Data - Detector Board

The sections below explain the signal and data paths required for result processing in the various operating modes:

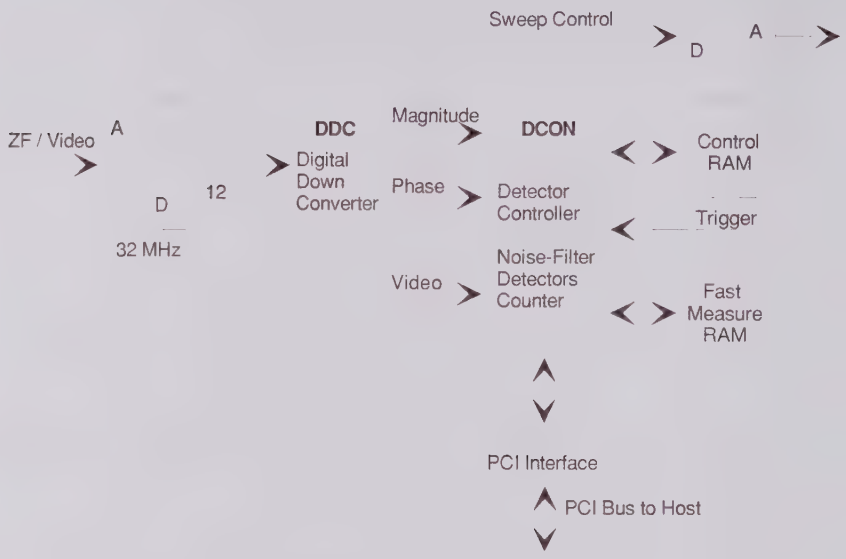


Fig. 3-6 Processing of measured data

Spectrum Analysis Using an RBW >100 kHz

In this mode, only the analog resolution filters on the IF filter board are used. The signal applied to the A/D converter via the input IF/Video is therefore already a log video signal. The signal is continuously sampled at 32 MHz in the ADC and digitized.
The signal path is now directly routed to the DCON.

In the DCON, the data is directly applied to the noise filter. The noise filter is used to limit the video bandwidth or to average the noise content. The signal path is routed to the detector logic where the results are processed, i.e. peak max, peak min, sample, average and RMS values as well as the number of measured max. peak, min. peak, sample, average, RMS and quasi peak values are determined.

With measurement data rates > 1 MHz, detector data has to be stored in the measurement RAM because online storage is no longer possible at these high speeds. Upon completion of the sweep, the sweep data is read by the host from the measurement RAM, processed and displayed.

Spectrum Analysis Using an RBW ≤ 100 kHz

In this operating mode the resolution bandwidths are generated digitally with the aid of the DDC (digital down converter). The IF filter module provides an IF signal pre-filtered at 20.4 MHz. The DDC mixes the input signal into the complex baseband using an NCO, and then filters the obtained I/Q signal via an HDF (high decimation filter) and an FIR (finite impulse response) filter. The magnitude and phase are calculated from the I/Q data and transferred to a second gate array in the DCON. As in operating mode RBW > 100 kHz, the signal is video-filtered and weighted depending on the set detector.

FFT Bandwidths

In FFT bandwidth mode, the synthesizer is set to the desired frequency via the DCON which also generates the tuning voltages for the analog hardware. The signal path is routed via ADC, Corr RAM and DDC. The DDC first mixes the input IF into the baseband using an NCO; then the obtained I/Q signal is filtered in a HDF (**h**igh **d**ecimation **f**ilter) and FIR stage (**f**inite **i**mpulse **r**esponse). The I/Q output data is then stored by the DDC in the I/Q RAM. With data logging completed, the I/Q data from the I/Q RAM is transferred to the host via DDC and PCI interface FPGA. The host then performs the FFT for this sweep section.

Video Bandwidths (VBW)

The video filters of the R&S FSU can be adjusted between 1 Hz and 10 MHz in steps of 1/2/3/5. They are designed as a digital lowpass filter for the video signal. The video bandwidth can either be coupled to the resolution bandwidth (= default setting) or manually set to a fixed value.

Detectors

The R&S FSU uses a detector for the positive peak (peak+) and one for the negative peak value (peak-). In the sample mode, the video signal can also be directly sampled by the A/D converter without a peak detector being required. *Quasi-Peak*, *Average* and *RMS* detectors are available in addition. The RMS detector forms the rms value of the input signal for one point in the display during the measurement time.

1st Local Oscillator- RF Converter

The 1st local oscillator is a YIG oscillator on the RF converter. It is synchronized via a fractional N divider to the synthesizer signal of 600 to 620 MHz or 20 to 40 MHz. This signal can be set with very high resolution in steps of less than MHz. With 20 to 40 MHz, a whole octave can be swept with one divider setting. This setting is used with a fast sweep time over big spans. The 600 MHz setting is used with spans below 200 MHz because of the better phase noise.

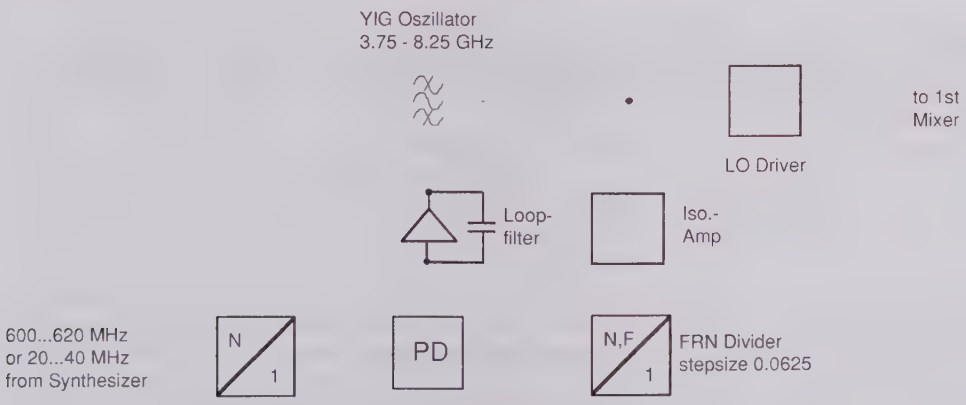


Fig. 3-7 Synchronization of 1st local oscillator

2nd Local Oscillator - Synthesizer

The second local oscillator is a DRO (dielectric resonator oscillator) on the synthesizer board at 4224 MHz. This oscillator is synchronized to a harmonic of the 3rd LO (384 MHz). This type of oscillator features excellent phase noise values.

3rd Local Oscillator- Synthesizer

The third oscillator is a VCO with ceramic resonator, which is synchronized via a mixer to the third harmonic of the crystal oscillator at 128 MHz.

Reference Frequency 128 MHz – Synthesizer

This reference is generated on the synthesizer board. To ensure perfect phase noise performance, an SC cut crystal is used as a resonator. The oscillator is synchronized with a bandwidth of approx. 30 Hz to the internal 10 MHz reference or to an external reference.

Harmonics of this signal are used for the synchronization of the 3rd local oscillator and the sweep oscillator 600 to 620 MHz.

It is also used to generate the 128 calibration signal via automatic level control. The level can be switched between 0 dBm and -30 dBm and adjusted with a D/A converter.
A 4:1 divider generates the 32 MHz clock for the detector board (A/D converter).

Reference Frequency 10 MHz – Synthesizer

The reference frequency is generated by an OCXO, and the frequency is adjustable by a D/A converter. If the external reference input is used, this OCXO is switched off and the external signal is used instead.

OCXO Reference (Option R&S FSU-B4)

The R&S FSU contains the option R&S FSU-B4, an oven-controlled reference oscillator with extra low aging and improved phase noise at 10 Hz offset. If the option is installed, this OCXO is used instead of the OCXO on the synthesizer board. If an external reference is used, both OCXOs are switched off. The heater of the B4 option stays on.

Sweep VCO - Synthesizer

The sweep VCO on the synthesizer board is used to synchronize the YIG oscillator on the RF converter. An oscillator with ceramic resonator at approx. 600 MHz is used. This VCO can be tuned over quite a small range of about 20 MHz for good phase noise performance. A bigger tuning range would reduce the quality factor of the resonator. The oscillator is mixed with a comb line of the 128 crystal oscillator to an IF between 20 and 40 MHz. Via this IF, the VCO is synchronized to a digitally generated signal from a fractional N divider. This signal can be tuned in steps of smaller than 1 MHz in frequency. For small spans with a good phase-noise performance, the YIG oscillator is synchronized to the VCO, for fast sweeps and a big span to the IF.

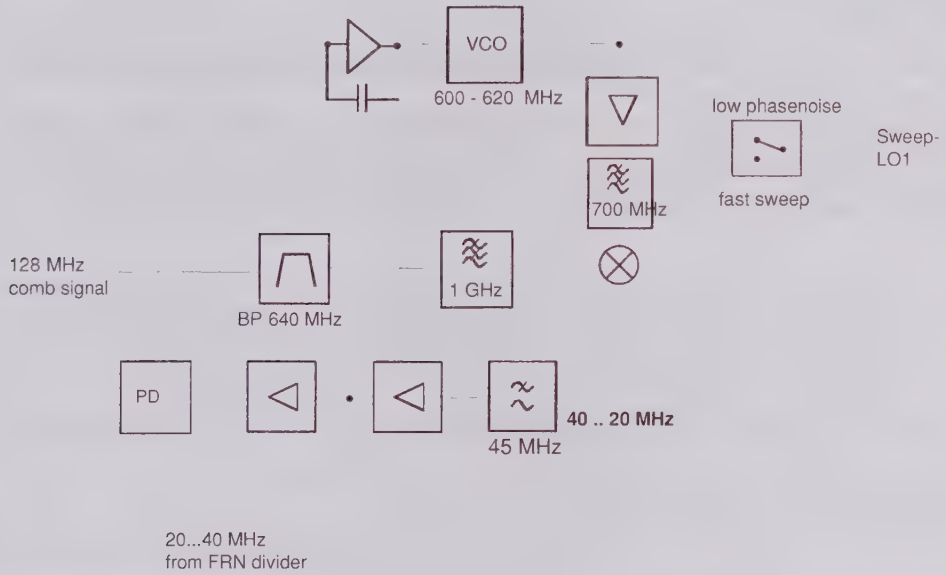


Fig. 3-8 Sweep synthesizer

Front Panel

The front panel consists of a mounting plate that accommodates the LCD, the keyboard mat with the membrane and the spinwheel. The case panel incorporates the front-module controller.

LCD
The colour LCD provides visible output of any information, measurements, etc, to the user. The resolution of the LCD is 800 * 600 pixels (SVGA).
The display includes a cold cathode tube for illumination. The high voltage required for this purpose is generated in an extra DC/AC converter mounted next to the display on the mounting plate and connected both to the display and the controller board via a cable.

Keyboard
The keyboard consisting of a keyboard mat and a membrane releases a contact when the rubber key is pressed. Two LEDs for the STANDBY/ON key (yellow for STANDBY/green for ON) are also accommodated on this membrane.
The key evaluation and LED control are carried out via a film cable connector on the controller board. Like the control of the two LEDs, control is performed in a special microprocessor on the controller board by means of a matrix technique. This microprocessor permits the status of the STANDBY/ON key to be stored when switch-off is performed with the power switch.

Front module controller
The front module controller contains all the necessary components on a board such as processor, memory chips (SIMM modules), I/O devices (ISA bus), lithium battery, IEC/IEEE-bus controller, two

serial interfaces (COM1/2), a parallel interface (LPT), LCD graphics controller, external VGA monitor graphics interface (monitor) and an external keyboard connection (keyboard PS/2).
In addition, a floppy controller for an external floppy disk drive and an IDE hard disk controller are integrated on the controller board.

Hard disk

The hard disk is screwed to the rear panel of the front module controller and connected to the printed circuit board via a ribbon cable.

Power Supply Module

The power supply module provides all currents necessary for operating the FSU. It can be switched off by means of the power switch on the rear panel.
The power supply module is a primary-clocked switching power supply with power factor correction (PFC) and standby circuit (+12 V standby).

On the secondary side, it generates DC voltages (+3.3 V; +5.2 V; +6 V; +8 V; +12 V; +12 VFAN; +12 V standby; +28 V; -12 V).

The control signal STANDBY/ON controlled by the front module controller (depending on the operating key STANDBY/ON on the front of the instrument frame) activates the power supply. In standby operation, it only supplies the 12 V standby voltage for the crystal oscillator and the LED STANDBY on the front panel.

The secondary voltages are open-circuit-proof and short-circuit-proof with respect to ground and each other.
An over-temperature protective circuit is additionally installed to prevent overheating. The status is taken to the front module controller via a status signal (*OT*).

Fuses
Two fuses are also installed in the power supply as a means of fire protection.

Note: *These fuses are not accessible to the user from outside and are blown only in the case of a serious fault in the power supply (servicing required!).*

Motherboard

The motherboard generates the -6 V supply for the analog boards with an integrated DC/DC converter.
The noise source output (28 V noise source) is also generated on this board.
All external supplies (probe, keyboard, etc) are short-circuit-protected by polyswitches (current-dependent, self-opening and closing fuses).

On the motherboard, a circuit for temperature-dependent instrument fan control is also implemented.

Probe / Keyboard

The probe / keyboard PCB is located at the front of the instrument frame and accommodates the external interfaces KEYBOARD (PS/2) and PROBE POWER connector. For connection with the motherboard, a ribbon cable is used.

Volume / Phones

The volume/phones board is located on the front mounting plate and accommodates the external interfaces PHONES (headphones connector) and the volume control (rotary encoder) for the AF demodulator.
For connection with the motherboard, a ribbon cable is used.

Tracking Generator (Option R&S FSU-B9)

In normal operation (no frequency offset), the tracking generator generates a signal exactly at the input frequency of the R&S FSU in the frequency range up to 3.6 GHz.

To support frequency-converting measurements, a constant frequency offset of ±200 MHz between the input frequency of the R&S FSU and the output signal of the tracking generator can be set. In addition, I/Q modulation or AM or FM of the output signal can be performed using two analog input signals.

The output level is controlled and can be adjusted between -30 dBm and 0 dBm in 0.1 dB steps (between -100 dBm and + 5 dBm with the option R&S FSU-B12).

External Generator Control (Option R&S FSP-B10)

The external generator control option permits a number of commercially available generators to be operated as tracking generators on the R&S FSU. The generator is controlled via the – optional – second IEC bus interface of the R&S FSU (= IEC2, supplied together with the option); with some Rohde & Schwarz generators, it can also be controlled via the TTL synchronization interface included in the AUX interface of the R&S FSU.

Flash Disk (Option R&S FSU-B20)

If the option R&S FSU-B20 is used, a flash disk can be substituted for the hard disk in the instrument. The compact flash board contains two connectors for compact flash cards of type 1 and one connector for a link to the IDE interface of the front module processor.

External Mixer Port (Option R&S FSU-B21)

The external mixer port option enables the R&S FSU (model 26 or later) to be operated with external mixers to extend the frequency range. The option consists of a module that provides the LO output (7 GHz to 15.2 GHz) and an IF input (404.4 MHz) for the external mixer.

Preamplifier 26.5 GHz (Option R&S FSU-B23)

A connnectible preamplifier can be used to improve the noise figure of the R&S FSU26 above 3.6 GHz. The preamplifier is integrated in the microconverter module and is thus only available directly from the factory.

Module Replacement

This section describes in detail the replacement of modules. Chapter 5 provides information on how to order spare parts; it contains the list of mechanical parts with order numbers and the illustrations for board replacement.

Note: *The numbers indicated in brackets refer to the item position in the list of mechanical parts in chapter 5.*

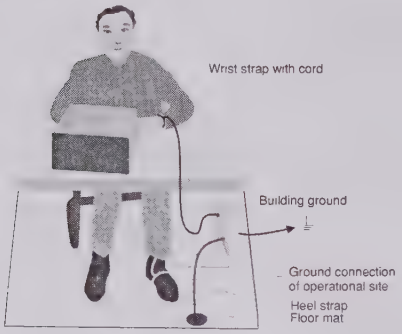
These items correspond to the item numbers in the illustrations for board replacement (see also chapter 5):

1166.1660 (R&S FSU Basic Model, items 1-455),
1166.1677 (Dig. Basic Unit, items 500-775),
1093.4708 (Display Unit, items 800-950),
1144.9017 (option R&S FSU-B4, items 1100-1130).
1162.9921 (option R&S FSP-B28, items 1360-1380)
1144.9300 (option R&S FSU-B25, items 1400-1460)
1145.0259 (option R&S FSU-B18, items 1500-1560)
1129.7298 (option R&S FSP-B10. items 1600-1630)
1155:1612 (option R&S FSU-B20, items 1700-1730)
1142.9090 (option R&S FSU-B9, items 1800-1960)
1130.2544 (8 GHz MW Converter, items 2000-2035)
1130.3240 (≥26.5 GHz MW Converter , items 2100-2165)
1157.0907 (option R&S FSU-B23, items 2106)
1142.9361.00 (option R&S FSU-B12, items 2400-2445)
1157.1090 (option FSU-B21, Pos. 2900-2960)

Note: *The words "left" and "right" in the manual always refer to the front view of the instrument.*

Caution!

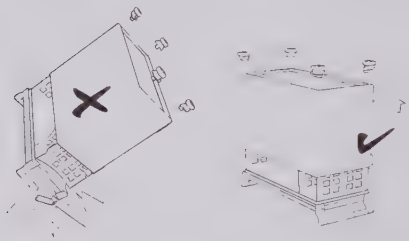
- *Please observe the safety instructions at the beginning of this manual.*
- *Disconnect the instrument from the mains before opening the case.*
- *Protect the replacement site against electrostatic discharge to avoid damage to electronic components of the modules.*



- *The following two methods of ESD protection may be used together or separately:*
-

- Wrist strap with cord to ground connection

- Conductive floor mat and heel strap combination



- *Place the instrument on its front handles before loosening the rear feet and the enclosure to avoid damage to the instrument.*
- *When mounting the enclosure, be sure not to damage or pull off cables.*

Performing a Cold Start

A cold start has to be performed as described below each time a module containing an EEPROM has been replaced.

- Connect the power cable and press the power switch.
- While the ON key is pressed, the decimal point key must be pressed and held down until the computer responds with a beep.

After this, Windows XP starts the device firmware.

Overview of the Modules

Table 3-1 Overview - module replacement

Module	Required tests and adjustments after replacement		
	Function tests and system error correction	Adjustment	Other
Front module controller	SYSTEM MESSAGES/ SELFTEST / CAL		DOS/BIOS update
Lithium battery	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Hard disk	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot / FW update
LCD / DC/AC-converter			
Keyboard membrane or mat			
Front cover			
Floppy disk drive	Check of directories		
Power supply	SYSTEM MESSAGES/ SELFTEST / CAL		
Fan			
RF input connector	SELFTEST / CAL	Frequency response	
Motherboard	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot EEPROM entry
RF attenuator	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Key probe and vol./phone	Voltage / keyboard / volume		
RF Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Detector	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
IF filter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ cal. source	Cold boot
MW Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ frequency response	Cold boot
OCXO B4	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy	Cold boot
External Generator Control FSP-B10	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
LAN interface B16			
Removable HD B18			
Flash Disk -B20	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot FW update
Electr. Attenuator -B25	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
External Generator Control -B10	SYSTEM MESSAGES/ SELFTEST / CAL		
Tracking Generator -B9	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Attenuator for Generator -B12	SYSTEM MESSAGES/ SELFTEST / CAL		
External Mixer -B21	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot/
Preamplifier 26.5 GHz -B23	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	
Trigger Port B28	SYSTEM MESSAGES/ SELFTEST / CAL		

Replacing Front Module Controller A90

(see chapter 5, spare parts list, item 571 and illustrations 1155.5001 and 1166.1677)
The front module controller is mounted behind the front panel.

Opening Instrument and Removing Front Panel

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo 2 countersunk screws (610) in the front frame, at the top and at the bottom.
- Remove the front panel with keyboard and display (600, 621, 631, 641, 650, 660) towards the front and turn it toward the top of the instrument.

Caution!
Note that the connecting cables are still connected to the controller.

- Disconnect the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane, spinwheel and, if required, network connector.

Note: *When removing the connecting cables, be careful with the cable connecting the keyboard. It is a film cable that can only be disconnected after sliding up the lock of the film cable plug.*

Removing Front Module Controller

- Undo the 10 screws with washers (590) of the front module controller board and take out the front module controller as follows (see also Fig. 3-9):

Note: *The front module controller is tightly inserted on the motherboard.*
It can be pulled off towards the front using the slots at the bottom of the mounting plate.
Carefully push the board towards the front step by step using a flat, blunt tool.

Caution:

Do not insert the tool too far into the slots and press only against the PC board !
To pull out the board, carefully it pry off at all slots alternately.
The board must not be bent!

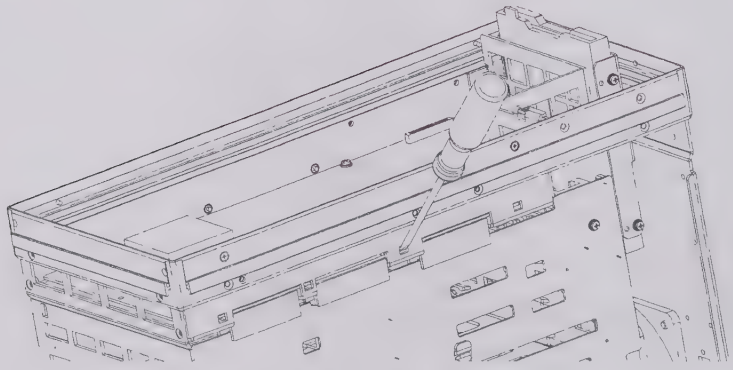


Fig. 3-9 Removing the front module controller

Installing New Front Module Controller and Completing Instrument

- Carefully plug the new front module controller to the motherboard and fasten it in place using the 10 screws with washers (590).

  Caution: Short-circuits might occur between controller components, lines and screws (590) on the FMR6, 1091.2520.00. Place an insulating mat underneath!

- Carefully plug the cable connectors to the controller board, taking care not to reverse the polarities.

Front Module Controller Typ FMR6

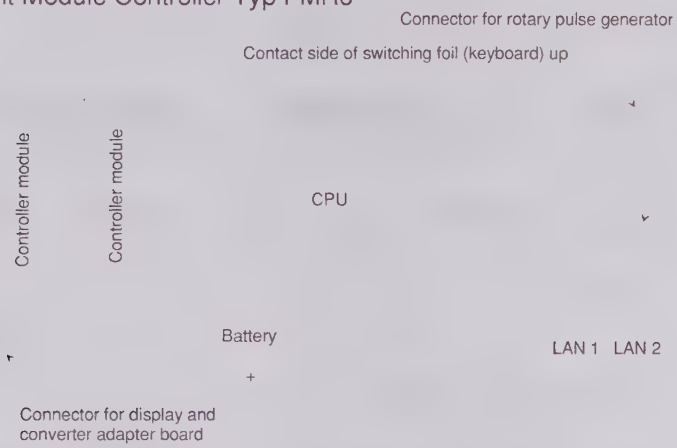


Fig. 3-10 Position of connectors on front module controller

- Rotate the front panel into the R&S FSU and fasten in place using 4 countersunk screws (610) in the front frame.

Caution!

Make sure to route the cables properly.

- Install the front cover (270).
- Mount the 2 front handles (420) on the instrument using the 4 screws (430).

Putting Instrument into Operation

- Connect the instrument to AC supply and switch on the power switch. The instrument is now in stand-by mode.
- Insert a floppy disk with DOS and BIOS update into the floppy disk drive.
- Switch on the R&S FSU and wait until the first beep. Press the FILE key. The BIOS update starts.
- When programming the flash EEPROM, the FSQ must not be switched off.
- Follow the message indicated in the display, then switch the FSQ off and on.
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST] , then [SELFTEST RESULT]
- Start total calibration and check the results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing Lithium Battery on Front Module Controller

(see chapter 5, spare parts list, item 776 and illustrations 1166.1660 and 1166.1677)

The lithium battery is accommodated on the front module controller board behind the front panel.

Caution!

Lithium batteries must not be exposed to high temperatures or fire.

Keep away from children.

If the battery is replaced improperly, there is a danger of explosion. Only replace the battery by an R&S type (see chapter 5, spare parts list, item 776 for type FMR6).

Lithium batteries are hazardous waste and must be disposed of in dedicated containers.

Opening Instrument and Removing Front Panel

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the front panel with keyboard and display (601, 621, 631, 641, 650, 660) towards the front and rotate it to the top of the instrument.

Caution!

Note that the connecting cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, network connector from the front module controller.

Note: *When removing the connecting cables, be careful with the cable to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

Removing Lithium Battery

➢ Carefully lift and remove the battery.

Note: *3.4 V lithium battery (∅ 20 mm * 3 mm) R&S Order No. 0858.2049.00*

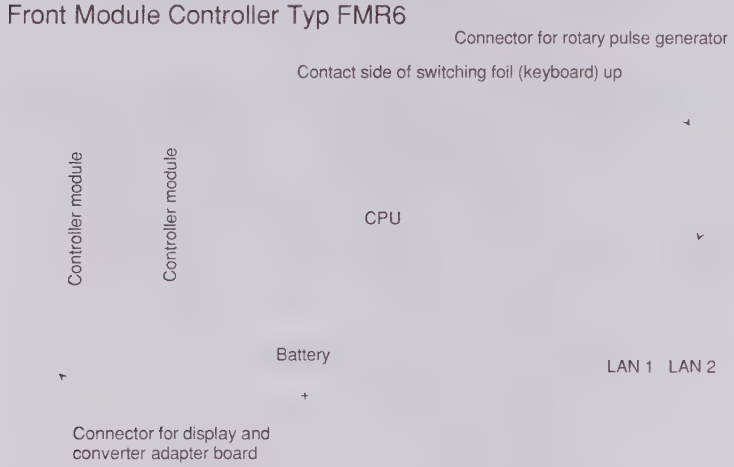


Fig. 3-11 Position of lithium battery on front module controller

Installing New Battery and Completing Instrument

Caution!
Do not short-circuit the battery.

➢ Insert battery into holder below the spring.

Note: The positive pole (+) of the battery points up.

➢ Rotate the front panel back into the R&S FSU and fasten in place using 4 countersunk screws (610) in the front frame.

Caution!
Make sure to route the cables properly.

➢ Install the front cover (270).

➢ Mount the 2 front handles (420) again using the 4 screws (430).

Putting Instrument into Operation

- Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.
- After battery replacement, a cold boot is required. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing Hard Disk A60

(see chapter 5, spare parts list, item 710, and illustations 1166.1660 and 1166.1677)

The hard disk is located between the front module and the boards.
The spare part contains the complete software.

Opening Instrument and Replacing Hard Disk

- Switch off the instrument, disconnect the AC supply plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Disconnect the ribbon cable (720) at the hard disk.
- Undo the 2 countersunk screws (740) on the hard disk mounting plate (730).
- Take the hard disk (710) with the mounting plate (730) out of the R&S FSU.
- Undo the 4 countersunk screws (750), remove the hard disk and mount a new hard disk to the mounting plate (730).

Installing New Hard Disk and Putting Instrument into Operation

- Mount the hard disk with the mounting plate into the instrument using 2 screws (740).

  Note: *Be careful with the lower cover plate locking in the provided opening.*
- Connect the ribbon cable (720) to the hard disk.

  Note: *Connect cable according to illustration 1166.1677 in chapter 5 .*
- Place the top cover (240) onto the instrument and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and fasten the 4 rear-panel feet (450) using screws.
- Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.
- After replacement of the hard disk, a cold boot is required. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing LCD and DC/AC Converter in Front Module

(see chapter 5, spare parts list, items 601, 921 and 871, and illustrations 1166.1660, 1166.1677, 1093.4708)

The LCD is accommodated on the mounting plate together with the associated DC/AC converter. It is connected to the front module controller via cables, which can also be replaced individually. For replacement, proceed as follows:

Opening Instrument and Removing Front Module

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- Pull out the front module with keyboard and display (601, 621, 631, 641, 650, 660) towards the front as far at it goes.

Caution!
Note that the connecting cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, network connector on the front module controller.

  Note: *When removing the connecting cables, be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

- Place the front module with the keys onto a clean surface.

Removing DC/AC Converter

- Pull off the connecting cable from the display (921) to the DC/AC converter (871).
- Disconnect cable (905) to DC/AC converter (871).
- Remove the DC/AC converter (871) after undoing the 2 screws (892).

Removing LCD

- Unscrew 2 screws with washers (946) and unplug the display cable (945).
- Undo the 4 screws with washers (930) and remove the display (921).

Installing New LCD and/or DC/AC Converter and Putting into Operation

- To insert the new LCD and/or DC/AC converter, proceed in the reverse order, connect all cables in the correct position and tighten all screws (drawing 1093.4708).
- When replacing the display (921) or display cable (945), affix a new adhesive label (946) for cable safety.
- Place the front panel with the keys on top of the instrument so that the cables can be connected to the front module controller.
- Carefully plug the cable connectors to the controller board without reversing the polarities.

Front Module Controller Typ FMR6

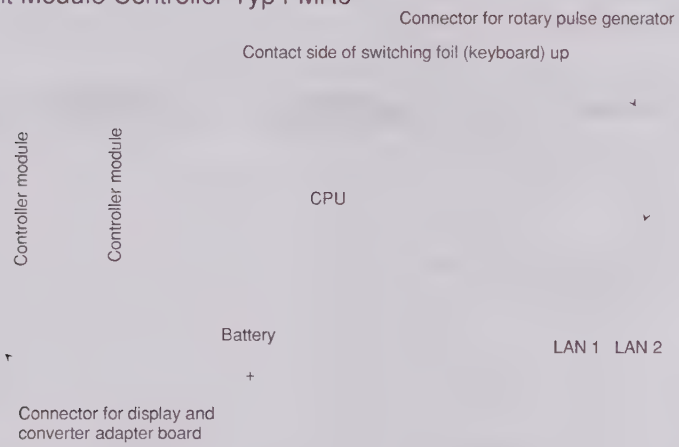


Fig. 3-12 Position of connectors on front module controller

- Rotate the front panel back into the instrument and fasten it in place using 4 countersunk screws (610) in the front frame.

Caution!
Make sure to route the cables properly.

- Install the front cover (270).
- Mount the 2 front handles (420) again using the 4 screws (430).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing Keyboard Membrane or Mat on Front Module

(see chapter 5, spare parts list items 631 and 641, and illustrations 1166.1660, 1166.1677)

The keyboard membrane is the contact film for the rubber keys (mat) behind the front cover and the keyboard frame.

Opening Instrument and Removing Front Panel

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- Pull out the front module with keyboard and display (601, 621, 631, 641, 650, 660) towards the front and put it on top of the instrument with the keys facing the instrument.

Caution!
The cables are still connected to the controller .

- Disconnect the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, the network connector.

  Note: *When removing the cables, be careful with the cable connecting the keyboard. It is a film cable that can only be disconnected after sliding up the lock of the film cable plug.*

Removing Membrane

- Place the front panel onto a clean surface with the keys pointing upwards.
- Pull off the knob (650) of the spinwheel.
- Undo the 10 countersunk screws (660) and remove the keyboard frame (621).
- The keyboard membrane (641) as well as the mat (631) can now be replaced.

Installing New Membrane and Completing Instrument

- Insert the new mat (631) into the keyboard frame (621) from the back.

  Note: *The pins of the mat must be inserted into the holes at the keyboard frame.*

- Position the new keyboard membrane (641) on the back of the mat (631).

  Note: *Push the foil cable of the membrane through the slot in the mounting panel. The membrane must be positioned so that the pins of the mat are inserted into the holes in the membrane.*

- Position the mounting plate with the display on the membrane (641).

  Note: *The display must be positioned so that the pins of the mat are inserted in the holes in the mounting plate (805).*

- Press the front panel together, turn the keys to the top and fasten in the keyboard frame using 10 countersunk screws (660).
- Place the front panel with the keys on the top of the instrument so that the cables can be connected to the front module controller.
- Carefully plug the cable connectors to the controller board without reversing the polarities.

Front Module Controller Typ FMR6

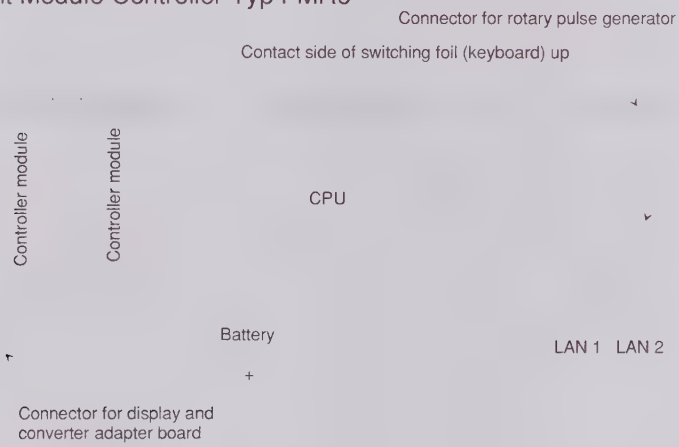


Fig. 3-13 Position of connectors on front module controller

- Rotate the front panel back into the R&S FSU and fasten it in the front frame using 4 countersunk screws (610).

Caution!
Make sure to route the cables properly.

- Install the front cover (270).
- Mount the 2 front handles (420) using the 4 screws (430).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing Front Cover on Front Module

(see chapter 5, spare parts list, items 270/280/290/292, and illustration *1166.1660*)

The front cover is the outer front panel that carries the labels. Each model has its own front cover.

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Install the new front cover and reassemble the instrument in the reverse order.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing Floppy Disk Drive A30

(see chapter 5, spare parts list, item 670, and illustrations 1166.1660, 1166.1677)

Opening Instrument and Removing Floppy Disk Drive

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Remove 3 screws (700) at the fan side of the R&S FSU and carefully pull out the floppy disk drive (670) with the floppy mounting plate (680) pointing towards the top.

  Note: *The cable is still connected to the motherboard.*
- Disconnect the cable at the floppy disk drive.

Installing New Floppy Disk Drive and Completing Instrument

- Undo the 3 screws with washers (700) and remove the floppy disk from the mounting plate (680) and mount a new disk drive (670) to the floppy mounting plate (680).
- Connect the cable (690) to the disk drive (note the contact side of the cable).
- Insert the floppy mounting plate (680) and fasten it to the fan side using 2 screws with washers (700).

  Note: *Please mount the floppy disk drive in the middle of the front-panel breakout.*
- Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Push the enclosure (410) onto the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Function Test

- The instrument boots and the firmware starts.
- Insert a 3 ½" disk with any files.
- Press the FILE key, then the FILE MANAGER and EDIT PATH softkeys.
- Enter "a" and ":" and confirm with the Enter key.
- The directory structure of the inserted disk must be displayed on the screen.

Replacing Power Supply A20

(see chapter 5, spare parts list, item 550, and illustration *1166.1677*)

The power supply is installed at the rear of the instrument frame.

Removing Power Supply

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.
- Undo the 10 screws (560) at the rear of the power supply.
- Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.

Installing New Power Supply

- Place the instrument onto the front handles and install the new power supply in the reverse order.

  Note: *Make sure that the 96-contact connector to the MOTHERBOARD locks in place correctly.*
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the AC supply and switch it on.
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check resultw:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing Fan

(see chapter 5, spare parts list, item 15, and illustration 1166.1660)

The fan is installed at the right side of the frame.

Opening Instrument and Removing Fan

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Remove the fan (15) by loosening the 4 screws.
- Disconnect the fan cable at the motherboard connector X35 (FAN) .

Installing New Fan and Completing Instrument

- Connect the fan cable to the motherboard connector X35 (FAN)
- Mount the new fan using 4 screws.

  Note: *Please note the direction of the airflow printed on the fan. The fan must blow the cold air into the instrument.*

  Make sure to route the cable so that it cannot get into the fan.
- Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing RF Input Connector (Cable W1) R&S FSU3/8

(see chapter 5, spare parts list, item 295, and illustration 1166.1660)

The RF input connector is installed at the bottom right side of the front panel.
Depending on the frequency range, different cables W1 are available.

Opening Instrument and Removing Cable W1

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Remove 3 countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (61).
- Unscrew the cable W1 (295) to 7 GHz or W1 (315) to 30 GHz at the RF attenuator (20) or (30).
- Remove the connector mounting plate (61) together with W1 and the probe/key module (50) towards the front.

  ***Note**: The probe/key module (50) is connected by a ribbon cable to the motherboard X80.*
- Undo the 4 countersunk screws (350) and remove cable W1 together with mounting plate (330) or (340).

Installing New Cable and Completing Instrument

- Put the mounting plate (330) or (340) onto the new cable W1 and fasten it in place using 4 countersunk screws (350), insert the mounting plate (61) into the instrument and screw it to attenuator (20) or (30).
- Fix 3 countersunk screws (70) in the instrument frame and 1 countersunk screw (70) in the mounting plate (61).
- Install the front cover (270).
- Mount the 2 front handles (420) again using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary.

Replacing RF INPUT Connector (Casing Adapter) R&S FSU26

(see chapter 5, spare parts list, Item 315, and illustration 1166.1660)

The input connector is at the bottom right of the front panel. Different connectors are used depending on the frequency range of the instrument.

Opening Instrument and Removing Casing Adapter

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Remove the 4 screws at the left and right front handles (430) and take off front handles.
- Pull off front cover (290) towards the front.
- Remove 3 countersunk screws (70) from frame and 1 countersunk screw (70) from mounting plate (61).
- Unscrew input cable W1 (316) from attenuator (25).
- Pull out mounting plate (61) together with cable W1 and the probe/key (50) and vol./phone board (43) modules towards the front.

  Note: *The probe/key (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.*

- Remove cable W1 together with mounting plate (340) after undoing 4 countersunk screws (350).
- Unscrew casing adapter (315) from cable W1 (316).

Installing Casing Adapter and Completing Instrument

- Screw new casing adapter (315) to cable W1 (316).
- Connect mounting plate (340) to cable W1, fasten it with 4 countersunk screws (350), fit it into the instrument together with mounting plate (61) and screw it to the attenuator (21).
- Fasten mounting plate (61) to instrument frame with 3 countersunk screws (70) and to mounting plate (61) with 1 countersunk screw (70).
- Remount the 2 front handles (420) by means of 4 screws.
- Slide on enclosure (410) and screw on the 4 rear-panel feet (450).
- Connect the AC supply cable, switch on power switch and press the ON key.
- Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response as described in Chapter 1 and correct it, if required.

Replacing ´RF-INPUT´ (Housing Adapter) R&S FSU>26

(see chapter 5, spare parts list, item 320, and illustration 1166.1660)

The input is located at the bottom right of the front panel. The input design will vary depending on the frequency range of the instrument.

Opening Instrument and Removing Housing Adapter

- Switch off the instrument, pull the mains plug, unscrew the 4 rear panel feet (450) and remove the enclosure (410) by pulling it toward the rear.
- Unscrew the 4 screws located on the left and right sides of the front handle (430) and remove the front handle.
- Pull off the front cover (292) toward the front.
- Unscrew the 3 countersunk screws (70) on the instrument frame and the 4 countersunk screws (70) on the subassembly plate (61).
- Unscrew the input cable W1 (322) on the attenuator (22).
- Pull out the subassembly plate (61) toward the front together with W1 and the Probe/Key board (50) and the Vol./Phone board (43).

  Note: *The Probe/Key board (50) and* Vol./Phone board (43) *are plugged into the motherboard X80, X81 via a flat cable.*
- Remove cable W1 after undoing 4 countersunk screws (350) with mounting plate (340).
- Unscrew housing adapter (320) from cable W1 (322).

Installing Housing Adapter and Completing Instrument

- Screw the new housing adapter (320) onto cable W1 (322).
- Feed mounting plate (340) to cable W1, fasten into place with 4 countersunk screws (350), insert back into instrument together with subassembly plate (61) and screw back onto attenuator (25).
- Fasten subassembly plate (61) via 3 countersunk screws (70) on the device frame and 4 countersunk screws (70) on the subassembly plate (61).
- Put the front cover (292) back on.
- Reassemble 2 front handles (420) using 4 screws.
- Slide enclosure (410) back on and screw on 4 rear panel feet (450).
- Connect power cable, switch on power switch and press ON key.
- Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response as described in chapter 1 and correct if necessary.

Replacing Motherboard A10

(see chapter 5, spare parts list, item 510 and illustrations 1166.1660, 1166.1677))
The motherboard is located at the bottom.

Opening Instrument and Removing Motherboard

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on the side frame and remove all cables to the boards.
- Pull out all boards towards the top of the instrument.

  Note: *The boards can be disconnected from the motherboard by carefully pressing from the bottom through the motherboard slots.*

- Remove the power supply (550).
  Undo the 10 screws (560) at the rear of the power supply.
  Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the front panel with keyboard and display (601, 621, 631, 641, 650, 660) towards the front.

Caution:
Note that the cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, the network connector on the front module controller.

  Note: *When removing the cables, be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

- Remove the front module controller (see section "Replacing the Front Module Controller A90")
- Remove the screws of all motherboard connectors at the rear panel. Unscrew the bolts (530) at the COM and LPT ports and (540) at the Monitor port. Unscrew the nuts at the Noise Source and Ext. Trig connectors and the bolts at the IEC port.

  Note: *Do not change the bolts of the Monitor and the LPT or COM ports !*

- Disconnect the cables at the motherboard (RF attenuator, fan, floppy, probe/key, rear panel, etc).
- Undo seven screws with washers (520) at the lower side of the motherboard (510 or 511).
- Carefully pull the motherboard (510 or 511) towards the front panel (approx. 15 mm) and take it out of the instrument by swiveling down.

Installing New Motherboard and Completing Instrument

- Reinstall the motherboard in the instrument in the reverse order.

  Note: *Be careful when installing the motherboard in order not to cause damage to any components.*

- Make *sure to connect* the *cables according to their labels.*
- Insert the front module controller, front panel, power supply, boards and cables, top cover, enclosure and rear-panel feet in the reverse order.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Store the serial number of the instrument to the EEPROM:
  - [**SETUP** : SERVICE : ENTER PASSWORD "30473035"] , then input serial number of the instrument in HW-Info table (see also chapter 2, section " Adjustment of Module Data").

Replacing RF Attenuator A40

(see chapter 5, spare parts list, items 20 and 25, and illustration 1166.1660)

The RF attenuator is installed at the bottom behind the RF input connector.

Opening Instrument and Removing RF Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Place the instrument onto the left side and unscrew the RF cable or the diplexer (150) at the output of the RF attenuator.
- FSU3/8: Undo the 2 screws with washers (40) at the instrument frame.
  ***Note**: The RF attenuator is then only held via the RF cables at the front.*
- FSU26: Undo the 3 screws with washers (28) at the instrument frame.
  ***Note**: The RF attenuator is then only held via the RF cables at the front.*
- Hold the attenuator and disconnect RF cable W1 (295) on the R&S FSU3/8 ,cable W1 (316) or cable W1 (322) on the R&S FSU26 from the input of the RF attenuator.
- Carefully take out the RF attenuator and unscrew the flexible RF cable from the input.
- Disconnect ribbon cable from motherboard connector X41 on the R&S FSU3/8 or at X40 on the R&S FSU26.
- Only R&S FSU26: Remove RF attenuator (25) by undoing 4 countersunk screws (27) from insulating plate (26).

Installing New RF Attenuator and Completing Instrument

- Only R&S FSU26: fasten new attenuator (25) to insulating plate (26) with 4 countersunk screws (27).
- Connect ribbon cable to motherboard connector X41 on the R&S FSU3/8 or to X40 on the R&S FSU26.
- Connect the flexible RF cable to the input of new RF attenuator (see label on cable).
- Install the new RF attenuator in the instrument and connect cable W1 to the input.
- R&S FSU3/8: Fasten the attenuator to the instrument frame using the 2 screws with washers (40).
  R&S FSU26: Fasten the attenuator to the instrument frame using the 3 screws with washers (28).
- Fasten the RF cable to the RF output of the RF attenuator.
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains and switch on the power switch. The instrument is now in the standby mode.
- After replacing the attenuator, a cold start is required. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Key/Probe Module A80 and Vol./Phone Board A191

(see chapter 5, spare parts list, Pos. 43, 50 and illustration 1166.1660)

The boards are located behind the front-panel connectors Keyboard, Probe, Headphones and the volume control knob.

Opening Instrument and Removing Boards

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take out the enclosure (410) towards the back.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Remove volume control knob (48).
- Pace the instrument onto the left side so that its bottom side is accessible.
- Remove 3 countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (61).
- Unscrew the input cable W1 (295) or (315) at the RF attenuator (20) or (30).
- Remove the mounting plate (61) completely with W1 and Probe/Key board (50) and optional Vol./Phone board (1040) towards the front.

  Note: *The Probe/Key (50) and Vol./Phone (43) boards are connected to X80 and X81 on the motherboard via a ribbon cable.*

- Disconnect the cables of the 2 boards from motherboard connectors X80 and X81.
- Undo the 3 countersunk screws (55) and remove the Probe/Key board (50).
- Undo the 3 countersunk screws (46) and remove the Vol./Phone board (43) from the mounting plate (61).
- Undo the screw with washer (45) and the nut of the volume control at the mounting bracket (44) and remove the Vol./Phone board (43).

Installing New Boards and Completing Instrument

- Fasten the new Probe/Key board (50) to the mounting plate (61) using 4 countersunk screws (55).
- Fasten the new Vol./Phone board (43) to the mounting bracket (44) using the nut of the volume control and 1 screw with washer (45). Mount Vol./Phone board (43) to mounting plate (61) using 2 countersunk screws (46).
- Connect the cables of the 2 boards to motherboard connectors X80 and X81.
- Carefully slide the complete mounting plate (61) back into the instrument.

Caution

Make sure to route the cables properly.

- Screw RF cable W1 (295) or (315) to the input of the RF attenuator (20) or (30).
- Mount 3 countersunk screws (70) to the instrument frame and 1 countersunk screw (70) to the mounting plate (61).
- Install the front cover (270).
- Mount the volume control knob (48).
- Mount the 2 front handles (420) using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).

Function Test

- Connect an appropriate keyboard to the keyboard socket.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- Simultaneously press the CTRL and ESC keys on the keyboard. The Windows XP task bar will appear at the lower edge of the screen.
- Shift the cursor to MAINAPP using the trackball and click. The task bar will disappear.
- Measure the output voltages at the probe connector (see Fig. 3-14).

Pin	Signal
1	GND
2	-12.6 V
3	+15 V

Fig. 3-14 Pin assignments of PROBE POWER connector

- Test the function of headphones connector and volume control. Press the *MKR* key and then the *MARKER DEMOD* softkey. Noise can be heard in the loudspeaker, and the volume can be changed using the *VOLUME* knob at the front panel. Connect headphones to the *AF OUTPUT* at the front panel. The loudspeaker is switched off and the noise can be heard in the headphones.

Replacing RF Frontend A100

(see chapter 5, spare parts list, item 100, and illustration 1166.1660)

The board is located in the middle of the instrument .

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side frame and remove all cables connecting the board.
- Pull out board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing New Module and Completing Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labels on the motherboard.*
- Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable, and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary, using the correction software.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Synthesizer A110

(see chapter 5, spare parts list,, Pos. 105 and illustration 1166.1660)

The board is located in the middle of the instrument.

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables to the board.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.*

Installing New Module and Completing Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary, using the correction software.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Detector A140

(see chapter 5, spare parts list, item 110, and illustration 1166.1660)

The board is located in the front part of the instrument.

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board.
- Pull out the board towards the top of the instrument.

  Note: *The module can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.*

Installing New Module and Completing Instrument

- Plug the new board into the instrument and reconnect all RF cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on the power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing IF Filter A130

(see chapter 5, spare parts list, item 120, and illustration 1166.1660)

The board is located in the middle of the instrument.

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull out board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing New Board and Completing Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: Please observe the labeling on the motherboard.
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch and press the ON key.
- As of firmware version 1.6x, a cold start is required after replacement of the IF Filter. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency accuracy and the calibration source level according to chapter 1 and readjust according to chapter 2, if necessary.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- Write calibration data to the EEPROM (see chapter 2, section "Adjustment of Module Data").

Replacing 8 GHz Converter Unit A160; R&S FSU8

(see chapter 5, spare parts list, items 130 to 140, and illustration 1166.1660)
(see chapter 5, spare parts list, items 130 to 140, and illustration 1155.5001)

The board is located in the middle of the instrument.

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing New Module and Completing Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the GLORIS server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Diplexer A162; R&S FSU8

(see chapter 5, spare parts list, item 2030 and illustration 1130.2544)
The board is located on the 8 GHz Converter Unit.

Removing Diplexer on MW Converter 1130.2544

- Remove the 8 GHz Converter Unit (130).
  Note: See description "Replacing 8 GHz Converter Unit A160; R&S FSU8".
- Disconnect cable W1 from diplexer (2030).
- Undo 4 screws with washers (2035) from the bottom of the PCB.
- Remove diplexer (2006) perpendicularly to the PCB.
  Note: The diplexer is still connected to the PCB with contact pins.

Installing Diplexer on MW Converter 1130.2544

- Plug in new diplexer (2030) perpendicularly to the PCB.
  Note: The diplexer is connected to the PCB with contact pins.
- Refasten 4 screws with washers (2035) to the bottom of the PCB.
- Fit cable W1 to diplexer (2030).

Completing Instrument and Frequency Response Correction

- Put the 8 GHz Converter Unit (130) back into the instrument.
  Note: See description "Replacing 8 GHz Converter Unit A160; FSU8".
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the GLORIS server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing 8 GHz YIG Unit A161; R&S FSU8

(see chapter 5, spare parts list, items 2005 and 2010, and illustration 1130.2544)
The board is located on the 8 GHz Converter Unit.

Note: Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.

Removing 8 GHz YIG Unit

- Remove the 8 GHz Converter Unit (130).
  Note: See description "Replacing 8 GHz Converter Unit A160; R&S FSU8".
- Remove the 2 module covers by undoing the screws from the bottom of the module.
- Disconnect cable W1 from the diplexer (2030) and cable W2 from the 8 GHz converter circuit (2000).
- Depending on the YIG unit used, disconnect the cable from the YIG filter at X4.
- Undo 2 countersunk screws (2025).
- Remove the complete YIG unit (2005 or 2010).
  Note: YIG unit 1130.2944.02 (2005) *is connected to the PCB via contacts. Remove the YIG unit towards the top perpendicularly to the PCB.*

Installing 8 GHz YIG Unit

- Place the new YIG unit (2005 or 2010) on the PCB.
  Note: YIG Unit 1130.2944.02 (2015) is connected to the PCB via contacts. Plug the YIG unit into the connector contacts from the top perpendicularly to the PCB.
- Fasten the YIG unit with 2 countersunk screws (2025).
- Screw on cable W1 to the diplexer (2030) and connect cable W2 to the 8 GHz converter circuit (2000).
- Depending on the YIG unit used, connect the cable from the YIG filter at X4.
- Replace the module cover on the top of the Converter Unit (positioning by means of adjusting pins). Turn 8 GHz Converter Unit upside down, place module cover on the bottom side and refasten all screws.

Completing Instrument and Frequency Response Correction

- Place the 8 GHz Converter Unit (130) into the instrument.
  Note: See description "Replacing 8 GHz Converter Unit A160; R&S FSU8".
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the GLORIS server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Completing Instrument and Frequency Response Correction

- Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

➢ Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing ≥26.5 GHz MW Converter Unit A160; R&S FSU

(see chapter 5, spare parts list, item 140, 150 and illustration 1166.1660)

The board is located in the middle of the instrument.

Opening Instrument and Removing Module

Note: *The module can be disconnected from the motherboard connector by carefully pushing it upwards from the bottom through the motherboard slots.*

Installing New Module and Completing Instrument

Note: *Please observe the labeling on the motherboard.*

- As of firmware version 1.6x, a cold start is required after replacement of the MW Converter Unit. See section "Performing a Cold Start".
- After starting the instrument, check if the protocol file is correct:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Diplexer A161; R&S FSU ≥26.5 GHz

(see chapter 5, spare parts list, item 2105 and illustration 1130.3240, sheet 1)
The board is located on the ≥26.5 GHz MW Converter Unit.

Removing Diplexer

- Remove the ≥26.5 GHz Converter Unit (140 150).
  Note: *See description "Replacing ≥26.5 GHz MW Converter Unit A160; R&S "*
- Disconnect all cables from diplexer (2105).
- Undo 4 screws with washers (2110) from the bottom of the PCB.
- Remove diplexer (2105) perpendicularly to the PCB.
  Note*: The diplexer is still connected to the PCB with contact pins.*

Installing Diplexer

- Plug in new diplexer (2105) perpendicularly to the PCB.
  Note: The diplexer is connected to the PCB with contact pins.
- Refasten 4 screws with washers (2110) to the bottom of the PCB.
- Refasten all cables to the diplexer (2105).

Completing Instrument and Frequency Response Correction

- Put the ≥26.5 GHz MW Converter Unit (140) back into the instrument.
  Note: See description "Replacing ≥26.5 GHz MW Converter A160; R&S "Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing ≥26.5 GHz YIG Unit 162; R&S FSU

(see chapter 5, spare parts list, item 2530 and illustration 1130.3840)

The board is located on the ≥26.5 GHz MW Converter Unit.

Note: *Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.*

Removing ≥ 26.5 GHz YIG Unit

- Remove the ≥26.5 GHz MW Converter Unit (140, 150).
  Note: See description "Replacing ≥26.5 GHz MW Converter Unit A160; R&S FSU26"
- Disconnect cable W1 from the diplexer (2105) and cable W2 from the relay unit (2170).
- Disconnect cable from YIG filter at X4.
- Undo 3 cover screws holding the YIG unit (2115) from the bottom of the module.
- Undo 2 countersunk screws (2120).
- Remove the complete YIG unit (2115 or 2117).

Installing 26.5 GHz YIG Unit

- Put the new YIG unit (2115 or 2117) on the PCB.
- Fasten YIG unit with 2 countersunk screws (2120).
- Refasten 3 cover screws holding the YIG unit (2115 or 2117) to the bottom of the module.
- Reconnect cable W1 to the diplexer (2105) and cable W2 to the relay unit (2170).
- Connect cable from the YIG filter to X4.

Completing Instrument and Frequency Response Correction

- Put the ≥26.5 GHz Converter Unit (140) back into the instrument.
  Note: See description "Replacing ≥26.5 GHz MW Converter Unit A160; R&S FSU26".
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Extender ≥ 26,5 GHz A163; R&S FSU

(see chapter 5, spare parts list, item 2125 and illustration 1130.3240)
The board is located on the ≥26.5 GHz MW Converter Unit.

Removing Extender ≥ 26,5 GHz

- Remove the ≥26.5 GHz MW Converter Unit (140, 150).
  Note: See description "Replacing the ≥26.5 GHz MW Converter Unit A160; R&S FSU26".
- Disconnect all cables from Extender 26 (2125).
- Undo all cover screws from the bottom side of the module and remove cover (2165).
  Note: The cover on the top (2160) thus comes off.
- Undo 7 screws with washers (2130) from the Extender 26 (2125) at the bottom side of the module.
  Caution: The Extender 26 (2125) may drop out.
- Remove the Extender 26 (2125) perpendicularly to the PCB.
  Note: The Extender 26 is still connected to the PCB with contact pins.

Installing ≥ 26,5 GHz YIG Unit

- Plug in the new Extender 26 (2125) perpendicularly to the PCB.
  Note: The Extender 26 is connected to the PCB by means of connector contacts.
- Refit 7 screws with washers (2130) to the Extender 26 (2125) at the bottom of the module.
- Fit the module cover (2160) onto the top of the ≥26.5 GHz MW Converter Unit (positioning by means of adjusting pins). Turn the ≥26.5 GHz MW Converter Unit upside down, fit module cover (2165) to the bottom side and refit all screws.
- Reconnect all cables to the Extender 26 (2125).

Completing Instrument and Frequency Response Correction

- Put ≥26.5 GHz MW converter (140) back into the instrument.
  Note: See description "Replacing ≥26.5 GHz MW Converter A160; R&S FSU26"
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Tracking Generator A170 (Option: B9)

(see chapter 5, spare part list, item. 1800, and illustrations 1129.9003 and 1142.9090)
The board is installed in the rear part of the instrument.

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables to board at the bottom of the instrument.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing New Module and Completing Instrument

- Plug the new board into the instrument and reconnect the cables.
  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a cold start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check according to chapter 1, option Tracking Generator –B9.

Replacing Generator Attenuator A171 (Option: B12)

(see chapter 5, spare part list, item. 2400, and illustrations 1129.9003 and 1142.9361)
The board is installed in the rear part of the instrument (behind the fan).

Opening Instrument and Removing Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables W41 - X2 and W49 - X1 to tracking attenuator (2400).
- Disconnect flat cable of tracking attenuator (2400) on motherboard connector X270.
- Undo the 3 screws with washers (2420) and remove attenuator with holder.
- Undo the 2 screws M3 (2415) and remove the tracking attenuator (2400).

Installing New Attenuator and Completing Instrument

- Mount Tracking Attenuator (2400) with 2 screws M3 (2415) to attenuator holder (2410).
- Insert Tracking Attenuator with attenuator holder into unit and mount 3 screws with washers (2420).
- Connect flat cable of Tracking Attenuator (2400) to motherboard connector X270.
- Connect cable W41 - X2 and W49 – X1 to Tracking Attenuator.
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a cold start“.
- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check according to chapter 1, option Tracking Generator –B9 and Option Attenuator –B12.

Replacing OCXO A200 (Option: B4)

(see chapter 5, spare parts list, item 1100, and illustrations 1155.5001 and 1144.9017)

The board is installed in the front part of the instrument.

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables to board at the rear of the instrument.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing New Module and Completing Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch and press the ON key.

As of firmware version 1.6x, a cold start is required after replacement of the OCXO. See section "Performing a Cold Start".

- After starting the instrument, check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

(see chapter 5, spare parts list, item 1240, and illustrations 1129.9003 and 1144.9500)
The board is located in the front part of the instrument.

Replacing Combo Drive A381 (Option: B18)

(see chapter 5, spare parts list, item 1500, and illustrations 1155.5001 and 1145.0259)
The board is located on the top right of the front panel.

Opening Instrument and Removing Module

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the cover (240) of the instrument to left side and take off.
- Disconnect floppy power (691) and floppy data (1550) cables from combo drive (1500).
- Disconnect 44-contact flat cable from front module processor (570 or 571), remove cable tie and disconnect cable from combo drive (1500).
- Undo 3 screws with washers (700) and carefully take combo drive (1500) out of the instrument towards the top.
- Remove combo drive (1500) from holder (1505) by undoing 3 screws with washers (1506).

Installing New Module and Completing Instrument

- Fit new combo drive (1500) to holder (1505) using 3 screws with washers (1506).
- Carefully insert combo drive (1500) with flat cable into the instrument and fasten it to frame using 3 screws with washers (700).
- Route 44-contact flat cable from combo drive (1500) to front module processor (570 or 571) via cable ties and connect it. Lock cable ties.
- Reinstall floppy power (691) and floppy data (1550) cables to combo drive (1500).
- Place top cover on instrument (240) and fasten it with 10 countersunk screws (260) and 3 screws with washers (250).
- Push enclosure (410) back in place and fasten 4 rear-panel feet (450) by means of screws.
- Connect power cable, switch on power switch and press ON key.
- After starting the instrument, check if the protocol file is correct:
  - [SETUP : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check results:
  - [CAL : CAL TOTAL], then [CAL RESULTS]

Replacing Flash Memory Cards A61, A62 (Option: R&S FSU-B20)

(see chapter 5, spare parts list, item 1700 and illustrations 1129.9003 and 1155.1612)
The flash cards are located in the instrument between the processor and the modules. The spare parts are supplied with pre-installed software.

Note: *The flash memory cards can only be replaced in pairs. The spare part no. 1155.1641 includes 2 flash cards with pre-installed software.*

Opening Instrument and Replacing Flash Memory Cards

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the cover (240) of the instrument to left side and take off.
- Disconnect flat cable (720) from flash board (1700).
- Undo 2 countersunk screws (740) from flash board holder (730).
- Remove flash board (1700) with holder (730).
- Open clamps (1730) and remove flash memory cards (1710).

Installing New Flash Memory Cards and Putting Instrument into Operation

- Plug in new flash memory cards (1710) as indicated by the labeling and lock clamp (1730).
- Plug flash board (1700) and holder (730) into instrument and fix it with 2 countersunk screws (740).
- Refit flat cable (720) to flash board (1700).
- Place top cover on instrument (240) and fix it back with 10 countersunk screws (260) and 3 screws with washers (250).
- Push enclosure (410) back in place and fix 4 rear-panel feet (450) by means of screws.
- Connect power cable and switch on power switch. The instrument is in the standby mode.
- A cold start is required after replacing the flash memory cards. Switch on with the ON key and press the decimal point key at the same time until the computer outputs a beep.
- After starting the instrument check if the protocol file is correct:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing Electronic Attenuator A50 (Option: B25)

(see chapter 5, spare parts list, item 1400 and illustrations 1155.5001 and 1144.9300)
The board is located below the fan.

Opening Instrument and Removing Module

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Place instrument on its side and remove RF cables on both sides of the electronic attenuator (1400).
- Undo 4 screws with washers (1460) from the trough.
- Carefully remove electronic attenuator (1400).
- Connect flat cable (1410) to electronic attenuator (1400).

Installing Module and Completing Instrument

- Refit flat cable (1410) to new electronic attenuator (1400).
- Carefully reassemble new electronic attenuator (1400) and screw it to trough using 4 screws with washers (1460).
- Refit RF cables to both sides of electronic attenuator (1400).
- Push enclosure (410) back in place and fix 4 rear-panel feet (450) by means of screws.
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start".
- After starting the instrument check if the protocol file is correct:
  - [SETUP : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check if the result is correct:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check if the result is correct:
  - [CAL : CAL TOTAL], then [CAL RESULTS]
- Check frequency accuracy according to chapter 1 and adjust according to chapter 2, if required.

Replacing External Generator Control A210 (Option: B10)

(see chapter 5, spare parts list, item 1600, and illustrations 1155.5001 and 1129.7298)

The board is installed in the front part of the instrument .

Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 2 countersunk screws (260) on the top of the instrument and the 2 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Pull out the board towards the top of the instrument.

Installing New Module and Completing Instrument

- Plug the new board into the instrument.
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [SETUP : SYSTEM INFO : SYSTEM MESSAGES]

(see chapter 5, spare parts list, item 2700, and illustrations 1155.5001 and 1157.0136)

The board is installed in the front part of the instrument .

(see chapter 5, spare parts list, item 2710, and illustrations 1155.5001 and 1157.0136)
The board is installed in the middle of the instrument .

Replacing External Mixer Board A180 (Option B21)

(see chapter 5, spare parts list, item 2900, and illustrations 1166.1660 and 1157.1110)

The board is installed in the center part of the instrument.

Opening Instrument and Removing Board

- Switch off instrument, disconnect from mains, unscrew 4 rear panel feet (450) and pull off enclosure (410) toward rear.
- Remove the instrument cover toward the top (240) after undoing the 10 countersunk screws (260) on the cover top and the 3 countersunk screws (250) on the fan side and then swinging it toward the left.
- Undo RF cable W39 at the top of the external mixer board.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull the board out toward the bottom of the instrument.
  Do not damage RF cable W39 on the top!

  ***Note**: The board can be loosened from the motherboard connector by carefully applying pressure from the bottom through the motherboard slots.*

Installing Board and Completing Instrument

- Insert new board into instrument and reconnect all RF cables.

  Note: *Do not forget RF cable W39 at the top of the board. Note the labelling on the motherboard.*
- Place the instrument cover on the top (240) and screw it back on with ten countersunk screws (260) and 3 screws with washers (250).
- Slide on the enclosure (410) and screw on the 4 rear panel feet (450).
- After the external mixer board is replaced, a cold start must be performed. See section "3".
- Plug in the power cable, switch on the power switch and press the ON key.
- After starting the instrument, check the log file for any errors:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start the system error correction and check results:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check characteristics as defined in chapter 1,Test Sequence for Option External Mixer B21.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Diplexer Board with Preamplifier A161; (Option B23)

(see chapter 5, spare parts list, item 2106 and illustration 1130.3240.01 sheet 3)

The board is installed on the ≥ 26.5 GHz MW Converter Unit.

Removing Diplexer

- Remove the ≥26.5 GHz MW Converter Unit (140).
  Note: See description "Replacing ≥26.5 GHz *MW Converter Unit A160;* FSU26*"*
- Undo all cables on the displexer (2106).
- Unscrew 4 screws with washers (2110) at the bottom of the PCB.
- Remove the diplexer (2106) perpendicularly to the PCB.
  Note: *..The diplexer is still connected to the PCB with contact pins.*

Installing Diplexer

- Plug in the new diplexer (2106) perpendicularly to the PCB.
  Note*:.....The diplexer is connected to the PCB with contact pins.*
- Screw on 4 screws with washers (2110) at the bottom of the PCB.
- Screw on all cables to the diplexer (2106).

Completing Instrument and Correcting Frequency Response

- Plug the ≥26.5 GHz MW converter unit (140) back into instrument.
  Note: *See description "Replacing ≥ 26.5 GHz MW Converter Unit A160; FSU"*
- Run the "FSU-FRQ.EXE" frequency response software program.
  The software is located on the GLORIS server.
  - Test setup in accordance with menu item "Schematic" (connect external reference). Check IEC addresses and configurations of the instruments.
  - Press the Autoselect button and perform measurement with Run.
  - Select YIG to perform the frequency correction of the YIG filter.
  - After calibration, the frequency response is corrected for the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Troubleshooting

Malfunctions may have simple causes but may also be caused by faulty components.

These troubleshooting instructions can be used to locate error causes down to board level and make the instrument ready for use again by means of board replacement. For troubleshooting and diagnostics, a selftest is available that polls diagnostic voltages of the modules and displays limit value violations.

We recommend shipping the instrument to our experts in the service centers (see address list at the beginning of this manual) for module replacement and further error elimination.

Warning!

Do not plug or unplug boards prior to disconnecting them from the AC supply!

Be careful not to cause short-circuits when measuring voltages!

The following utilities are provided in the R&S FSU for diagnostic purposes:

- Permanent monitoring of levels and frequencies in the instrument
- Selftest
- System error correction

Note: *When problems occur, first check whether any connections (cables, plug-in connections of boards, etc) are damaged or wrongly connected.*

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S-Order No.	Use
1	DC meter		URE	0350.5315.02	Troubleshooting
2	Spectrum analyzer	Frequency range 0 to 7 GHz	FSEB 20	1066.3010.20	Troubleshooting
3	Adapting cable	1m long SMP-to-SMA connection	-	1129.8259.00	Troubleshooting
4	Adapting cable	0.5m long SMP-to-SMP connection	-	1129.8265.00	Troubleshooting
5	Adapter board	Extension 150 mm high 48-contact, 2 mm spacing	-	1100.3542.02	Troubleshooting

Troubleshooting Switch-on Problems

- **Error: The R&S FSU cannot be switched on.**

Action	Possible error causes and further steps
Check power-on switch on the rear ⇓ Check yellow LED (stand-by). ⇓	Power switch OFF: Switch on power supply. LED remains dark: ➢ Measure voltage at X20.D24 (power supply unit) Rated value: +12 V ± 1V Voltage o.k.: Keyboard or controller faulty. No voltage: Remove IF filter or OCXO modules. ➢ Measure voltage at X20.D24 (power supply unit): Rated value: +12 V ± 1V Correct voltage: Removed module faulty No voltage: Power supply faulty or short-circuit at 12V standby.
Switch on instrument. Check green LED ⇓	LED remains dark: Measure PWR-ON signal on the power supply X20.B1: < 1V for ON Voltage > 1V: Keyboard membrane or controller faulty.
Power supply starts, screen remains dark?	Measure voltages on the motherboard, see "Short-circuit of one or more operating voltages".

- **Error: Short-circuit of one or more operating voltages**

Action	Possible error causes and further steps
At the bottom of the motherboard, check which of the voltages is short-circuited: Computer, hard disk, EEPROMs : X20.A7 to A10: rated value: +5 V2 Wideband detector unit: X20.A5 and X20.A6: rated value +3 V3 Analog boards: X130.A10: rated value +12 V X130.A9: rated value +8 V X130.A8: rated value +6 V X130.A12: rated value –12 V	One voltage is missing or very low: Remove the respective boards from the instrument one by one and repeat the measurement. If the voltage is supplied, the error is probably located on the module removed. ***Note:*** *The power supply switches off all voltages after a short time in the case of a short-circuit. Restart by pressing the Standby/On key.*

- **Error: Fan does not work.**

Action	Possible error causes and further steps
Check voltage at connector: X35 pins 1 + 3 : Rated value 7V	If there is no voltage, the fan is defective: Replace fan. If the voltage is too low, the fan is blocked or the power consumption is too high.

Troubleshooting Problems with Booting

- **Error:The R&S FSU does not start the measurement application.**

Following switch-on, the R&S FSU first boots the computer BIOS. After successful initialization of the computer, the Windows XP operating system starts up. Subsequently, the test application is loaded as a start-up program. Simultaneously, selftests are performed at various locations and error messages, if any, are output. The messages are disabled with normal operation, but can be enabled for troubleshooting purposes. When troubleshooting, it is advisable to connect a keyboard to the keyboard socket.

Normal action

➢ Start the R&S FSU.

After the R&S FSU is switched on, the following BIOS message is displayed:

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.0-17-2


02/12/2002-io815E-LPC47B2-6A69REFC2C-00
```

After the first beep, the computer starts the hardware test and the following message is briefly displayed at the lower edge of the screen:

```
, ESC to skip Memory test...
```

The test results are usually not displayed. If errors occur during the boot procedure, these messages may indicate defects.

➢ The messages can be made visible by pressing the "DISP" key following the beep. The keystroke is acknowledged by a second beep.

Then, all messages are displayed.

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.0-17-2

Main Processor : Intel Pentium III 700 MHz (100x7.0)
Memory Testing: 261120K OK  + 1024 Shared
Memory
                (= result of memory test)

02/12/2002-io815E-LPC47B2-6A69REFC2C-00
```

The memory test yields the memory capacity of the front module controller. The basic version of FMR6 provides 256 Mbyte. BIOS then starts to check the controller hardware. All PCBs found are displayed.

Error and error cause

If no result of the memory test is indicated, the memory is defective.

Normal action

Error and error cause

➢ This procedure may be interrupted using the "PAUSE" key on the connected external keyboard, any other key continues the program execution.

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.0-17-2

Main Processor : Intel Pentium III 700 MHz (100x7.0)
Memory Testing: 261120K OK + 1024 Shared
Memory

Primary Memory Clock is 100 MHz
Primary Master : IBM-DJSA-205 JS100AB0A
                 (depending on installed hard disk))
Primary Slave  : None
Secondary Master : None
Secondary Slave  : None

02/12/2002-io815E-LPC47B2-6A69REFC2C-00
```

If this hard disk entry is missing, the hard disk may be faulty

SETUP is then displayed.

➢ This procedure can also be interrupted using the "PAUSE" key.

The contents partly depend on the hardware provided:

```
Award Software Inc.
System Configurations

CPU Type          : Intel Pentium III      Base Memory       : 640K
Co-processor      : Installed              Extended Memory   : 260096K
CPU Clock         : 700 MHz                Cache Memory      : 256

Diskette Drive  A : 1.44M, 3.5 in.         Display Type      : EGA/VGA
Diskette Drive  B : None                   Serial Port(s)    : 3F8
Hard Disk Drive C : LBA ,ATA 66, 5001MB    Parallel Port(s)  : 378
Hard Disk Drive D : None                   EDO DRAM at Row(s) : None
                                           SDRAM at Row(s)   : 2 3
                                           Display Cache Size : None

PCI device listing.....
```

Bus No.	Device No.	Funct No.	Vendor /	Device ID	Class	Device Class	IRQ
0	2	0	8086	1132	0300	Display Cntrlr	10
0	31	1	8086	244B	0101	IDE Cntrlr	14
0	31	2	8086	2442	0C03	Serial Bus Cntrlr	11
0	31	3	8086	2443	0C05	SMBus Cntrlr	NA
0	31	4	8086	2444	0C03	Serial Bus Cntrlr	9
1	8	0	8086	2449	0200	Network Cntrlr	11
1	13	0	162F	1212	FF00	Unknown PCI Device	11

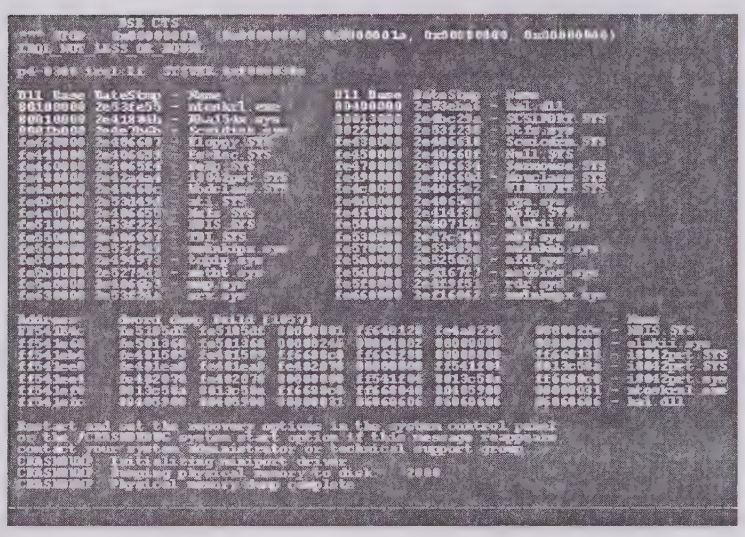
Normal action	Error and error cause
The PCI hardware test is displayed in the lower half of the screen. All modules found during the test are displayed with their names and PCI device IDs. The Device Class column lists the types of PCI devices. The wideband detector unit of the R&S FSU is indicated as "Unknown PCI Device".	If the line "Unknown PCI Device" is missing, the wideband detector unit has not been identified and the measuring application cannot be started. If the remaining PCI devices have all been identified, the wideband detector unit will probably contain the error, which is why the board must then be replaced.
After this test, the BIOS has been loaded and the operating system is started.	The message "No System Disk or Disk error ..." at this point indicates that the contents of the hard disk are not correct. Replace the hard disk.
After successful installation of Windows NT, the following selection menu is displayed: **Please select the operating system to start:** **Analyzer Firmware** **Analyzer Firmware Backup** **Use the up and down arrow keys to move the highlight to your choice.** **Press ENTER to choose.** **Seconds until highlighted choice will be started automatically: 0** **For troubleshooting and advanced startup options for Windows, press F8.**	If the instrument has started correctly so far, there is most probably no fault in the computer; the boot problem presumably results from a defective system file on the hard disk.
The Windows XP start screen will appear in a few seconds.	

Normal action

Before the operating system is started, the application for the R&S **FSU** is loaded in a start-up program. The program start is initiated automatically and generates a window that displays information about the start-up procedure.

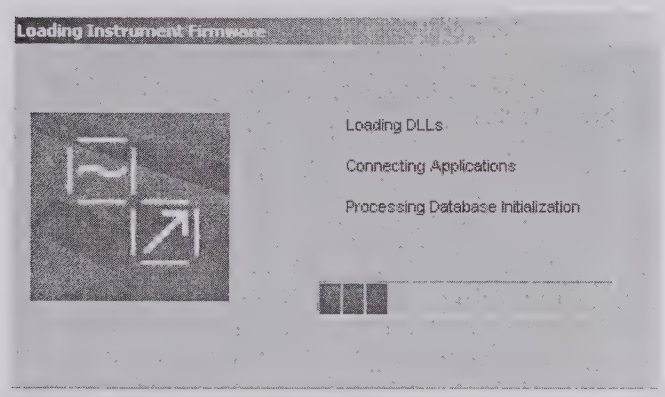
Error and error cause

If the operating system on the hard disk has been destroyed and cannot be loaded correctly, Windows XP displays a "bluescreen". This bluescreen contains all essential information about the internal states of the computer which are displayed as follows (by way of example):



Windows XP and the instrument firmware must then be updated from the back-up partition (see chapter 4, section "Software Update").

Normal action



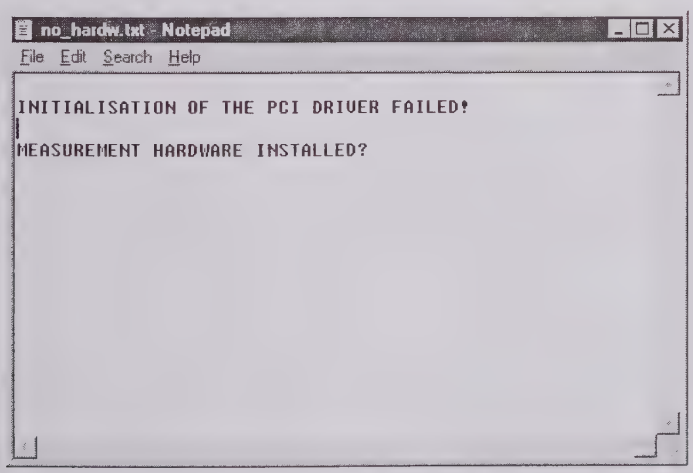
While booting, the wideband detector unit is identified again.

Error and error cause

If a "bluescreen" is displayed when loading, a cold start may be necessary. Proceed as follows in this case:

- Cold start (see section "Performing a Cold Start")
- Firmware update from the backup partition if cold start is not successful (see chapter 4).

If the wideband detector board is not identified, the following message is issued:

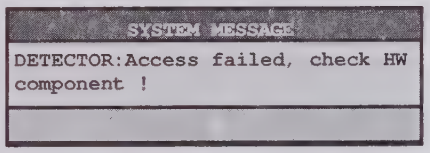


Normal action

When the program has been loaded, the measurement hardware is initialized first. A timer which is controlled by a 32 MHz clock signal is set on the detector board. This test reveals proper functioning of the detector board and the clock oscillator in the R&S FSU (RF converter).

Error and error cause

If there is an error on the detector board or the clock is missing, the following message is displayed:



After passing the function tests, the analog boards are initialized and the correction data EEPROMs are loaded.

➢ In this case, first check the clock generation in the instrument.

The reference is generated on the synthesizer. This 128 MHz reference is necessary for proper functioning of the detector board.

The following measurements are appropriate to check the reference supply:

Measurement:	**Result:**
Synthesizer A100, X114: rated value 128 MHz, 0 dBm ⇓	No signal: replace synthesizer.
Synthesizer A100, X114: rated value 32 MHz, 0 dBm	No signal:replace synthesizer.

If no error occurs with the clock generation, booting can be continued by acknowledging the error message using "OK"

If no error message or any other information on the error source is issued during booting, the error can only be determined by replacing the wideband detector unit or the front-module controller.

Troubleshooting - Loading Module EEPROMs

- **Error: Data of modules cannot be read.**

Normal action	Error and error cause
On booting the instrument, all calibration data required must be written to the RAM of the computer. The calibration data of a module is either read from the EEPROM (in the case of a cold start from EEPROM only) or from the associated binary file.	
The module information is read from the module EEPROMs in the case of a cold start. Otherwise the binary data is read from the hard disk during starting (e.g. motherb.bin).	
If reading at the desired address is not possible, the software assumes that the module is not available.	For modules that must always be available (e.g. IF filter), an error message will be output:
	Error reading EEPROM of IF Filter
The calibration data are then read from the file pertaining to the module (e.g. motherb.bin).	If the binary data cannot be read out without error, an error message will be output, e.g.:
	Error reading file of IF Filter
If reading at the address of an optional module is not possible, this module is marked as not available in the module array for storage of the module information. If the file pertaining to the non-available module does exist, it is assumed that upon the last successful booting the module was available but has been removed meanwhile. The file with the calibration data of the module is erased. Moreover, the data collected during the last calibration is invalid and only saved as a backup copy on the hard disk	If reading at the address of a module is possible but the contents of the data block are faulty (e.g. check sum of header block incorrect), the calibration data of the respective module is read from the associated file. The firmware assumes that the module is available. The information read from the file is entered into the array for storage of the module information.
	Error reading EEPROM of IF Filter

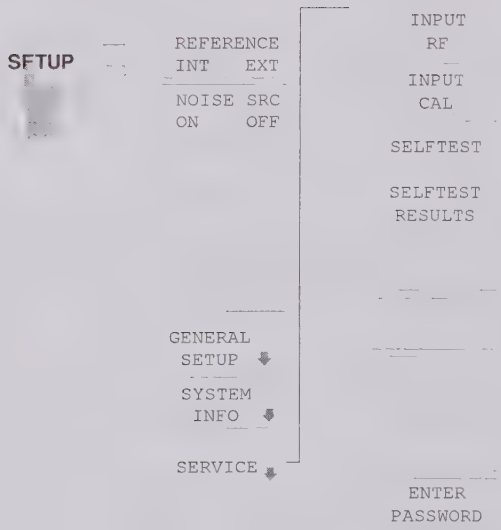
Normal action	Error and error cause
Upon successful reading of the module header from the EEPROM, the contents of the module header is compared with the module header of the associated binary file. If the module header can be read from the file and complies with the header read from the EEPROM, the assumption is made that the contents of the module EEPROM have already been mapped in the binary file. The calibration data can thus be written from the file to the RAM.	If, however, the associated file cannot be found or if the module header of the EEPROM differs from that of the file, the total EEPROM contents must be written to the RAM and then saved in the binary file. Error finding file of IF Filter
After loading the calibration data from the EEPROMs, the calibration data are loaded from the calibration data files (e.g. DDC settings for various filters). First the relevant calibration data file is written to the calibration data memory.	If an error occurs upon loading the file into the memory, an error message is output: Error reading file of DDC Filter
After loading the calibration data from the EEPROMs and files, the data collected during the last calibration is loaded from the 'rdf_cal.bin' file into the calibration data memory. This process takes place only if valid calibration data (and the 'rdf_cal.bin' file) is available.	If there is no valid calibration data, the status message "UNCAL " is output informing the user that the instrument is uncalibrated.

Troubleshooting via Selftest

The selftest is provided for identification of instrument errors and tolerance violations that cannot be corrected by self-calibration of the instrument.
All signal paths are connected and the signal is traced via test points. The selftest checks all possible hardware settings that are used for the self-calibration with regard to a sufficient setting range including reserves.

Service Level 1 - Test Following the Entry of a Password
When entering the password, the test result is recorded in detail and, in case of a fatal error (such as a failure of the operating voltage), the selftest is *not* aborted.

The selftest can be called in the *SETUP - SERVICE* menu:



➢ Enter the password 894129 with *ENTER PASSWORD*.

➢ Initiate the selftest of the instrument modules using the *SELFTEST* softkey.

While the selftest is running, a message box is displayed that shows the current test and test result.

➢ Pressing ENTER ABORT aborts the test run.

All modules are tested one by one and the test result (selftest PASSED or FAILED) is output in the message box

The *SELFTEST RESULTS* softkey calls a complete list of all test results.
If an error occurs, a brief description of the failed test, the module concerned, the valid range and the measurement value are displayed.

```
Total Selftest Status: ***FAILED***
Date (dd/mm/yyyy): 10/06/1999 Time: 16:34:47
Runtime: 05:59

Supply voltages detector
test description     min        max        result     state
+6V                  5.88       6.42       6.06       PASSED
+8V                  7.84       8.96       8.56       PASSED
+12V                11.76      12.83      12.42       PASSED
-12V               -11.33     -13.28     -11.85       PASSED
+28V                26.62      29.39      28.34       PASSED
```

If the result is ***FAILED***, look not only for entries marked with FAILED** but also those marked with SKIPPED. These entries indicate that a test item was not carried out, because the conditions had not been met. In this case, an error is present only if the instrument cannot be calibrated.
The selftest with password returns FAILED as the overall status, because the instrument will no longer be able to be calibrated in the near future due to temperature drift or aging.
The selftest without password returns the overall status of PASSED; in this case as well, however, the skipped test items are marked with SKIPPED as an aid for the service technician.

Running Selftest and Error Messages

Overview

The calibration source on the IF filter module is used as a signal source for testing the signal path.

1. Measurement of the operating voltages

   of the power supply
   regulated operating voltages on the detector and IF filter modules
2. Temperature measurement on the IF filter board
3. Testing the fourfold D/A converter on the detector
4. Synthesizer test
5. Lock test YIG oscillator and LO level test on RF converter
6. Testing of the signal paths on RF converter, IF filter and detector
7. Test of optional modules

All measurements on the analog boards are independent of the gate arrays on the wideband detector unit, since individual A/D converters are provided for them on the analog boards. The interface section in the FPGA of the wideband detector unit must function properly to read these A/D converters. This is always tested when the instrument is switched on.

The signal path via the gate arrays on the wideband detector unit is tested using a known, analog signal at the input of the A/D converter on the wideband detector unit. The analog test signal is provided by the preceding analog tests.

Since the operating voltages are measured first, it is ensured that the selftest can be performed correctly. If an operating voltage not required by the selftest has failed, this is correctly signaled in the error list. If, however, all operating voltages are indicated to be faulty, it may well be assumed that the operating voltage for the selftest has failed or the selftest A/D-converter itself is defective.

Testing Operating Voltages

When an operating voltage fails, the selftest is aborted to avoid subsequent errors.

The test is not aborted after entry of the password. All subsequent errors are then listed in the result record. Errors that have occurred irrespective of the voltage failure can then still be detected.

The error message indicates the error source (power supply, IF filter, wideband detector unit) and the voltage that has failed.

Normal action	Error and error cause
Power Supply The voltages of the power supply and the –6 V regulator (DC/DC converter from –12 V to –6 V on the motherboard) are measured at the board connector by means of the selftest A/D converter on the wideband detector unit.	
Channel: 1, Nominal voltage: +6V Channel: 2, Nominal voltage: +8V Channel: 3, Nominal voltage: +12V Channel: 4, Nominal voltage: -12V Channel: 5, Nominal voltage: +28V Channel: 7, Nominal voltage: -6V	FATAL ERROR! Power supply: DC FAIL +6V. Selftest aborted. ➢ If error messages occur, the voltages on the motherboard should be checked. The tolerances given in the column "Tolerance range power supply / voltage regulator" apply in this case. If the voltages are within the tolerance limits, the error must be located in the selftest: ➢ Replace the wideband detector unit.
Regulated voltages on the boards Wideband detector unit Channel: 6, Nominal voltage: -5V	FATAL ERROR! Detector: DC FAIL -5V. Selftest aborted. ➢ If no faults have been found in the preceding tests, the wideband detector unit has to be replaced.

Temperature Measurement on IF Filter

Normal action

The **temperature** is measured first.

Error and error cause

WARNING!

IF FILTER: Operating temperature xx °C - out of range

If the temperature does not lie within the permissible range of 0° to 70°C, the warning will be output.

➢ Check the temperature data for plausibility. The fan might be defective or the ventilation slots might be covered.

If the indicated temperature data is not plausible, e.g. 120° C when the instrument is cold, the temperature sensor or the selftest may be faulty.

If, in the following, the *first* operating voltage (or all operating voltages after entering the password) is measured incorrectly, the selftest will obviously be defective.

Subsequently the operating voltages are measured.

Channel	Nominal voltage	Expression displayed in the error message
74	- 5 V	UREF-5
77	+2.5 V	UREF+2.5
76	+3.3 V	+3.3 V
73	+5 V	+5 V
72	+10.6 V	+10 V
71	-5 V	-5 V
70	-10,6 V	-10 V
75	+5 V	+5 VR

➢ The IF filter board must always be replaced if an error message occurs that refers to these operating voltages or the temperature (if not plausible).
The voltage of the temperature sensor is used for temperature compensation of the filters. Thus, a faulty temperature sensor may detune the filters such that subsequent errors are likely to occur.

Checking 4-fold D/A Converter on Wideband Detector Unit

Normal action	Error and error cause
Wideband Detector Unit Pretune-DAC Test The 4-fold D/A-converter on the wideband detector unit is checked. One D/A converter controls the frequency-dependant IF gain on the IF filter for frequency response correction. The other ones are provided for options (microwave converter, tracking generator). The first output voltage of the 4-fold D/A converter is measured, thus checking the basic function of the control interface (in DCON gate array), also.	

Channel	Nominal voltage
8	666 mV

FATAL ERROR!
Detector: Pretune DAC FAIL - check DCON and pretune DAC
Selftest aborted.

➢ Replace the wideband detector unit

Testing Synthesizer

Normal Action		Error and error cause

Chan-nel	Voltage nominal	Expression displayed in the error message
11	- 5 V	-5 V
01	+5 V	+5 V
21	+7 V	+7 V
60	+12 V	+12 V
41	+28 V	+28 V

➢ If there is an error message referring to these operating voltages, the synthesizer is always to be replaced.

Temperature measurement:
The synthesizer accommodates a temperature sensor for the module temperature and one monitoring the heater of the 128 MHz reference oscillator.

Test channel 71

WARNING!
Synthesizer: Temperature out of range

Test channel 51

WARNING!
Synthesizer: Temperature 128 MHz reference range

➢ In the case of an impermissible temperature, tuning the 128 MHz oscillator to the correct frequency may not be possible since the SC cut crystal used is specified for a temperature of 70 °C.

Reference signals on the synthesizer
The control loops on the synthesizer are checked for the locking status and the set control voltage.

10 MHz OCXO level:
Level detector channel 00.

FATAL ERROR!
10 MHz OCXO defective !

➢ Replace the synthesizer in case of error.

128 / 384 MHz oscillators:
Testing the 128 MHz crystal oscillator and the third LO.

ERROR!
Reference 128 MHz / 3rd LO unlocked !
Reference 128 MHz / 3rd LO out of tuning range !

The instrument may still work properly, but the tuning voltages are almost at the limit or the frequency accuracy is out of tolerance.

➢ Replace/adjust the synthesizer.

Normal action	Error and error cause
Sweep synthesizer: Testing the tuning voltage at the sweep VCO 600 (595) - 620 MHz	ERROR! Sweep synthesizer unlocked ! Sweep synthesizer out of tuning range ! If the sweep VCO fails, the YIG oscillator does not lock or it locks at an incorrect frequency and also signals unlock. ➢ Replace synthesizer.
Second local oscillator Testing the tuning voltage at the 4224 MHz oscillator	FATAL ERROR! 2nd LO tuning voltage out of range ! If the second local oscillator fails, it is possible that the YIG oscillator does not lock or it locks at an incorrect frequency and also signals unlock. ➢ Replace synthesizer
Calibration signal control voltage: Checking the detector voltage in the level control of the Cal signal	ERROR! Calibration signal error If the control voltage is out of tolerance, the level control loop unlocks and the level becomes inaccurate. In the case of a small level error, the selftest of the signal path is possible. However, the level measuring accuracy will be out of tolerance after instrument calibration. ➢ Replace synthesizer.

Testing RF Converter

Normal action

Channel	Voltage nominal	Expression displayed in the error message
60	+5 V	+5 V
61	2.5 V	DAC Reference
62	+7 V	+7 V
63	+11 V	+11 V
64	+28 V	+28 V

Error and error cause

➢ The RF converter is always to be replaced if there is an error message referring to these operating voltages.

Temperature measurement:

The RF Converter accommodates a temperature sensor for the module temperature.

Test channel 67

WARNING!

RF Converter: Temperature out of range

➢ Check air supply and fan for proper functioning.

Test LO level

The level detectors of the second and third LO are read:

Channel	Oscillator	Expression displayed in the error message
3	LO 3	Level 3rd Local
2	LO 2	Level 2nd Local

➢ In the the voltage is too low, also check the level at the module input in the selftest poll! Setting Center, Zero Span

➢ + 10 dBm / 384 MHz at X 101

➢ + 7 dBm / 4224 MHz at X105

If the levels are correct, replace the RF converter. If the levels are not okay (deviation > 3 dB), measure the signals at the synthesizer again and replace the synthesizer, if necessary!

YIG oscillator test:

The YIG oscillator is tuned throughout the entire frequency band. The pretuning (with upper and lower limit) is also tuned with a small offset from the actual frequency. If the current flowing through the YIG coil and set by the PLL reaches one of these limits, the unlock detector will respond. This is a test both for the pretuning values and for functioning of the PLL.

FATAL ERROR!
YIG Oscillator unlocked !

➢ Replace the RF converter in the case of error.

Test input mixer

The mixer diodes both rectify part of the LO power. The two voltages can be polled via the selftest channels 0 and 1.

If the two voltages are missing or too low, the LO level is presumably missing, which is why an error message appears:

FATAL ERROR!
1st LO level low or 1st mixer defective !

If the two voltages differ (>20 %), the mixer is asymmetric, i.e. one of the two diodes is damaged.

FATAL ERROR!
1st Mixer symmetry out of tolerance !

In both cases:
Replace RF converter

Testing Signal Path via Attenuator

The internal source for the test signal (CAL signal) has already been tested when testing the reference signals. The first and second mixer feature sufficient LO power, i.e. the conversion from the RF to the second IF should therefore work properly.

Normal action	Error and error cause

Signal path via RF attenuator
The measurement is made at the second IF using a logarithmic detector on the RF converter. The 0 dBm test signal is measured with the following attenuator settings:

RF-Att	Coupling	Test
0	DC	Reference measurement
0	AC	AC/DC switch +-5 dB
5	DC	5-dB attenuator +- 5 dB
10	DC	10-dB attenuator +- 5 dB
20	DC	20-dB attenuator +- 5 dB
40	DC	40-dB attenuator +- 10 dB

➢ If there is **no** measured value within the tolerance range, the error is likely to be located in the subsequent signal path. It is not likely that all attenuator stages and the 0-dB position are faulty; therefore, the following error message appears.

FATAL ERROR!
Input level RF converter out of tolerance !

➢ Before replacing the RF converter, measure the input level at X108 in any case. For this purpose, the input is connected to the Cal source with 0 dBm and 0 dB attenuator DC coupling. The level should lie at 128 MHz and 0 dBm. Otherwise, check level at X125.

➢ If the level is okay, replace the RF converter.

➢ If the signal is not applied at the synthesizer either, replace the synthesizer.

➢ If only individual measurements are out of tolerance, the RF attenuator is defective.

FATAL ERROR!.
RF Attenuator xx dB pad failed !

Caution: Since a faulty RF attenuator causes many subsequent errors to occur with the IF filter test, proper functioning of the attenuator is a must.

Signal Paths on IF Filter Board

Normal action	Error and error cause
Input level of IF filter / calibration amplifier (CAL-Amps 1 + 2)	FATAL ERROR! IF board: IF input level / CALAMP Selftest aborted Possible error causes: • Signal path interrupted in the RF converter. • Erroneous EEPROM data in the RF converter leading to incorrect setting of CAL_Amp1. • CAL_Amp1 or 2 faulty. Troubleshooting ➢ Check the level applied at X132 with 0 dBm mixer level: Nominal –3 dBm, production tolerance ± 3 dB, max. permissible ± 4.5 dB; ➢ Replace the RF converter if the deviation exceeds this value. If the level lies within the tolerance, a defective CAL_Amp may have caused the error. The setting ranges of the CAL_Amps are later tested during the selftest. The selftest is not interrupted after entry of a password. ➢ Note whether the result file contains any error messages concerning the CAL_Amps. If there is no CAL_Amp error, the CAL_Amps will be set incorrectly. The EEPROM data in the RF converter are obviously incorrect.
LC filter I and XTAL filter The level measurement is performed with wide and narrow bandwidths of the LC filter. Subsequently, an additional measurement is performed via the crystal filter. If the LC filter does not work properly, the measurement of the crystal filter is not performed.	ERROR! IF board: LC Filter-1/2 wide XTAL Filter not tested ERROR! IF board: LC Filter-1/2 narrow XTAL Filter not tested ERROR! IF board: XTAL Filter ➢ The IF filter board must be replaced in all cases.

Normal action	Error and error cause
StepGain (IF amplifier) The 10 dB Step Gain (Step Gain Coarse) and the 0.1 dB Step Gain (Step Gain Fine) are tested. The input level is attenuated in steps of 10 dB by the RF attenuator and simultaneously amplified by means of the StepGain by the same amount. The level detector C checks to ±6 dB (user) or ±4 dB (service level 1).	FATAL ERROR! IF board: Step Gain Fine Selftest aborted ➢ Test with Step Gain Coarse bypassed (0 dB) and Step Gain Fine set to 0 dB. If an error occurs, Step Gain Fine does not work correctly or the signal path is interrupted. ➢ Replace the IF filter board. ERROR! IF board: Step Gain Coarse ➢ Testing the amplifier stages. ERROR! IF board: Step Gain Fine ➢ Testing the amplifier stages. ***Attention:*** *If the RF attenuator test has already caused an error message, Step Gain cannot be tested and an error message must be ignored!* ➢ If the RF attenuator test passed without any error, Step Gain is defective. ➢ Replace the IF filter board. However, the selftest can be continued since it does not require the IF gain.

Signal Paths on Wideband Detector Unit

Normal action	Error and error cause
Various settings of the wideband detector unit are checked via the normal display function, i.e. FFT mode, digital filters and analog filters. Possible error messages:	ERROR! Detector Board: FFT Detector Board: FIR Detector Board: Video

Troubleshooting RF Converter 1

Depending on the kind of error, a few measurements should be performed on the RF converter before the module is replaced:

- IP3 too high
- Signal level too low
- LO feedthrough too high
- Spurious signals

These errors may be caused by a defective input mixer. Since this mixer is directly connected to the input connector, it may be easily destroyed by the user.

A defective mixer can be recognized from a very high display of > -10 dBm at the frequency 0 Hz with 0 dB input attenuation.

Action	**Error and error cause**
Measure with diode tester at X101: rated value: approx. 0.6 V voltage in the forward and reverse directions with a current of 1 mA.	Different values in both directions, high-impedance or very low-impedance: mixer defective : replace RF converter

- **Signal missing or displayed with incorrect frequency**

If the signal is missing or the instrument signals "LOUNL", the conditioning of the 1st LO is probably not correct. The function of this oscillator requires both the EEPROM data and the reference frequency of the second module.

Action	**Error cause/remedy**
Measure function of the 1st LO in zero span. check signal at X107: rated value: 4628.4.4 MHz above the current input frequency (between 0 Hz and 3.6 GHz) and the signal level is approx. –5 dBm.	The frequency is considerably higher or lower or the signal is not stable replace RF converter

Troubleshooting MW Converters

The most common error on MW converters is that the displayed signal level on the signal analyzer > 3.6 GHz is too low or missing altogether.

Level ratios on MW converter

Action	Error cause/remedy
Feed in a high-frequency signal (f > 3.6 GHz) at the input of the MW converter at a level of –20 dBm and measure the IF level at the output using a spectrum analyzer. The center frequency of the R&S FSU is to be set to the frequency of the signal generator, and the span to 0 Hz. When operated on an adapter, the LO (connector X102 RF converter), und beim FSU 46 der 2. LO (Buchse X114 Syntesizer) must be taken to the MW converter (connector X167 / X1611). **R&S FSU 8:** - Diplexer input X169 - Output X161 **R&S FSU 26:** - YIG filter input X168 - Output X162 **R&S FSU 46:** - Diplexer input X168 - Output X162 Output level at 404.4 MHz: > -20dBm	If the level is missing or too low, a module on the MW converter is defective. The level ratios of the modules on the MW Converter Unit need to be checked (see following items). If the measured level is within the tolerance range, the attenuator or a subsequent board in the signal path is defective.

Level ratios on diplexer

Action	Error cauase/remedy
Feed in a high-frequency signal (f > 3.6 GHz) on the input of the diplexer at a level of -20 dBm and measure the level at the output. **R&S FSU 8:** - Diplexer input X169 - Diplexer output X8 **R&S FSU 26:** - Diplexer input X168 - Diplexer output X5 **R&S FSU 46:** - Diplexer input X168 - Diplexer output X7 Output level >-27dBm	If the level is missing or too low, the diplexer needs to be replaced. (see "Replacing Diplexer"). If the measured level is within the tolerance range, one of the subsequent boards on the MW converter is defective.

Level ratios on YIG filter unit

Action	Error cause/remedy
Feed in a high-frequency signal (f > 3.6 GHz) on the input of the YIG filter at a level of –25 dBm and measure the level at the output. The R&S FSU is to be set to the center frequency of the signal generator and at a span of 0 Hz. - Input J1 - Output J2 Output level: >-33 dBm	If the level is missing or too low, the YIG filter unit needs to be replaced (see "Replacing YIG Filter Unit"). If the measured level is within the tolerance range, one of the subsequent boards on the MW converter is defective.

Level ratios on RF extension

Action	Error cause/remedy
Feed in a high-frequency signal (f > 3.6 GHz) on the input of the RF extension at a level of –10 dBm and measure the level at the output. The R&S FSU is to be set to the center frequency of the signal generator and at a span of 0 Hz. When operated on an adapter, the LO (connector X102 RF Converter) must still be taken to the MW Converter (connector X167). **R&S FSU 26:** - Input: X1 - Output: X3 Output level at 404.4 MHz: f = 3.6 GHz to 26.5 GHz: >-26dBm **R&S FSU 46:** - Input: X1 - Output: X4 Output level at 404.4 MHz: f = 3.6 GHz to 26.5 GHz: >-26dBm f = 29.6 GHz to 42.3 GHz: >-30 dBm - Input: X1 - Output: X5 Output level at 4.6284 GHz: f = 27 GHz: >-30 dBm f = 45 GHz: >-35 dBm	If the level is missing or too low, the RF extension needs to be replaced. (see "Replacing Extender 26").

Contents - Chapter 4 "Software Update/Installing Options"

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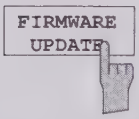
4 Software Update / Installing Options

This chapter contains information on software updates, restoring the operating system installation and installing options on the R&S FSU. Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

Installation of New R&S FSU Software

A new firmware version can be installed using the built-in diskette drive. The firmware update kit contains several diskettes.
The installation program is called up in the *SETUP* menu.

SETUP sidemenu:



The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update

IE/IEEE-bus command: --

Performing the update:

Insert diskette 1 into the drive.
Call *SETUP* side menu *[**SETUP**][**NEXT**]*
Start update *[FIRMWARE UPDATE]*

The *RESTORE FIRMWARE* softkey restores the previous firmware version

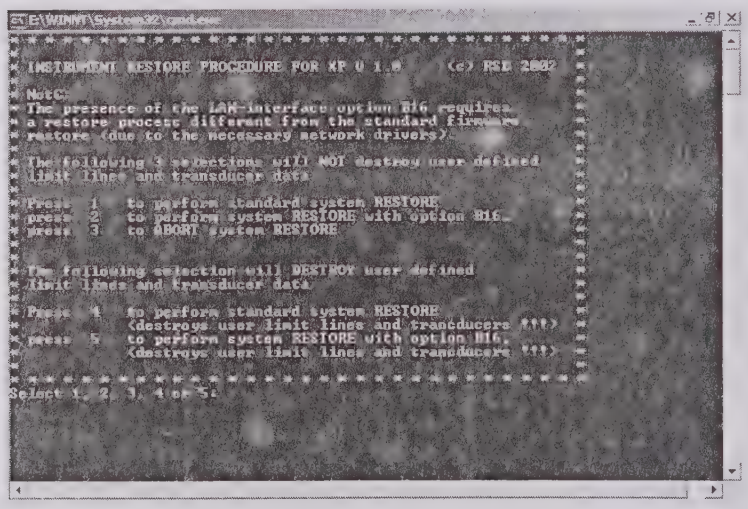
IEC/IEEE-bus command: --

Restoring Operating System Installation

If the operating system can no longer be started, it is possible to start the analyzer in the boot menu from the backup partition and to restore the operating system installation. This function is not available on instruments with option R&S FSU-B20.

```
Please select the operating system to start:

    Analyzer Firmware
    Analyzer Firmware Backup

Use the up and down arrow keys to move the highlight to your
choice.
Press ENTER to choose.

Seconds until highlighted choice will be started automatically: 5

For troubleshooting and advanced startup options for Windows,
press F8.
```

Use the cursor keys to select the operating system to start within the boot menu (*Analyzer Firmware Backup*) from the backup partition and confirm with ENTER.


INSTRUMENT RESTORE PROCEDURE FOR XP V 1.0 (c) RSE 2002
NOTE:
The presence of the LAN-interface option B16 requires
a restore process different from the standard firmware
restore (due to the necessary network drivers).
The following 3 selections will NOT destroy user defined
limit lines and transducer data
Press 1 to perform standard system RESTORE
press 2 to perform system RESTORE with option B16
press 3 to ABORT system RESTORE
The following selection will DESTROY user defined
limit lines and transducer data
Press 4 to perform standard system RESTORE
(destroys user limit lines and tranducers !!!)
press 5 to perform system RESTORE with option B16
(destroys user limit lines and tranducers !!!)
Select 1, 2, 3, 4 or 5:

After the operating system has been started from the backup partition, a window with various restore functions appears.

The desired function can be started by entering the corresponding number. The operating system files will now be copied from the backup partition to the analyzer partition.

After all files have been copied, the instrument boots and the firmware is installed. A cold start is then performed automatically to detect the analyzer hardware.

Installing Options

The following options are available with the R&S FSU :

OCXO	FSU-B4	1129.6740.02
Tracking Generator	FSU-B9	1142.8994.02
External Generator Control	FSP-B10	1129.7246.02
Attenuator for Tracking Generator	FSU-B12	1142.8994.02
Removeable Hard Disk	FSU-B18	1145.0242.02
Flash Disk	FSU-B20	1155.1606.08
External Mixer	FSU-B21	1157.1090.02
RF Preamplifier 3.6 GHz to 26 GHz	FSU-B23	1157.0907.02
Electronic Attenuator	FSU-B25	1129.7746.02
Trigger Port	FSP-B28	1162.9915.02

For retrofitting, please note the mounting instructions enclosed with the options.
These mounting instructions can be inserted at this location in the service manual and will thus be available when needed.

Caution!

Disconnect the instrument from the mains before opening the casing. Also pay close attention to the safety instructions at the beginning of this manual.

The components used in the instrument are sensitive to electrostatic discharges which is why they are to be handled in accordance with the ESD regulations.

When installing hardware options, note the following:

- Switch off the instrument and pull the mains plug.
- Unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- After installing the option, replace the tube and screw the rear panel feet back on.

Caution!

When replacing the tube, be sure not to damage or pull off cables.

- Switch on the R&S FSU (cold start).
- Install additional software, if supplied, according to the instructions enclosed with the option.
- If an adjustment is required for this option, refer to the installation instructions for the option.

Contents - Chapter 5 "Documents"

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Shipping of Instrument 5.1

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5 Documents

This chapter provides information on the ordering of spare parts and contains the spare part list and the documents for the complete unit.

Shipping of Instrument and Ordering of Spare Parts

Please contact your Rohde & Schwarz support center or our spare parts express service if you need service or repair of your equipment or to order spare parts and modules.

The list of the Rohde & Schwarz representatives and the address of our spare parts express service are provided at the beginning of this service manual.

We require the following information in order to answer your inquiry fast and correctly and to decide whether the warranty still applies for your instrument:

- Instrument model
- Stock No.
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Shipping of Instrument

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection

➢ Repack the instrument as it was originally packed when transporting or shipping. The two protective caps for the front and rear panels prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

➢ If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Shipping of a Module

When shipping a module, then, also be also careful to provide for sufficient mechanical and antistatical protection

➢ Ship the module in a sturdy, padded box.

➢ Wrap the board into antistatic foil.
If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the enclosed packaging is conductive.
Exception: If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

Ordering Spare Parts

To deliver replacement parts promptly and correctly we need the following indications:

- Stock number (see component lists in this chapter)
- Designation
- Component number according to component list
- Number of pieces
- Instrument type the replacement part belongs to
- Stock No.
- Contact person for possible questions

The stock numbers necessary for ordering replacement parts and modules as well as power cables can be found further down.

Refurbished Modules

Refurbished modules are an economic alternative for original modules. It should be kept in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use but they are electrically and mechanically equivalent to new modules.

To find out which refurbished modules are available, please refer to your Rohde & Schwarz representative (or to the central service division, Rohde & Schwarz Munich).

Taking back Defective Replaced Modules

Defective modules of the replacement program which can be repaired are taken back within **3 months** after delivery of the replaced module. A repurchasing value is credited.

Excluded are parts which can not be repaired, e.g. PCBs that are burnt, broken or damaged by repair attempts, incomplete modules, parts which are heavily damaged mechanically.

The defective parts must be sent back with a **returned accompanying document** containing the following information:

- Stock number, serial number and designation of the dismounted part,
- **Precise** description of the error,
- Stock number, serial number and designation of the instrument the part was dismounted from,
- Date of dismounting,
- Name of the technician who exchanged the part.

A returned accompanying document is provided with each replacement module.

Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.

Important Note!

When replacing a module please note the safety instructions and the repair instructions given in chapter 3 and at the beginning of this service manual

When shipping a module be careful to provide for sufficient mechanical and antistatical protection.

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036.00	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0006.7107.00	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight	Europe (except Switzerland)

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Spare Part List

Mechanical Drawings

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List of parts including spare parts

The is constructed in accordance with R&S design 2000.

Overall dimension: W x H x L, 426,7 x 176,5 x 517

Rackmount: 4E 1/1 T450

Accessories: 19"-Adapter ZZA-411, Stock no. 1096.3283.00

Note: *The recommended spare parts are marked x in the like column.*

Table 5-2 List of all part and spare parts

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
Document 1129.9032.01 (FSU-instrument, Sheet 1 = FSU3/8, Sheet 2 = FSU26					
10	Basic Unit	1166.1677.02	1 S		
15	Fan	1091.1001.00	1 S	E1	x
17	Speaker	1129.9332.00	1 S	B1	x
20	Attenuator.(6-STUFIG) FSU3/8	1137.0599.02	1 S	A40	x
22	Attenuator FSU46	1046.5130.03	1 S	A40	x
25	Attenuator FSU26	1046.5130.02	1 S	A40	x
26	Insolating plate	1129.9690.00	1 S		
27	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
28	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
30	Ribbon cable W40	1130.2515.00	1 S	W40	
40	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
43	VOL/PHONES BOARD	1093.7094.02	1 S	A191	x
44	HOLDING BRACKET AF-OUT	1129.9326.00	1 S		
45	DIN6900-M2,5X6 -A2	1148.3059.00	1 S		
46	DIN965-M2,5X6-A4-PA	148.3288.00	2 S		
48	Rotary knob 13 ACHS-RD4T-GR	0852.1211.00	1 S		
49	Ring for rotary knob	0852.1228.00	1 S		
50	KEY-PROBE	1130.2996.02	1S	A80	x

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
55	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
61	Subassembly plate II	1155.5553.00	1 S		
70	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
81	Adhesive foil 30X20 SW	1093.9051.00	2 S		
83	Adhesive foil 30X20 SW	1093.9051.00	1S		
90	Cover RD15,9	0009.9200.00	1 S		
91	Cover RD15,9	0009.9200.00	2 S		
100	RF CONVERTER	1130.4001.02	1 S	A100	x
105	SYNTHESIZER	1130.2096.03	1 S	A110	x
111	DETECTOR BOARD 1	1130.2196.06	1 S	A140	x
120	IF-FILTER	1130.2296.03	1 S	A130	x
130	CONVERTER UNIT(8 GHZ)	1130.2544.03	1 S	A160	x
135	Angle bracket MW converter	1129.9384.00	1 S		
136	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
140	MW-CONVERTER UNIT 26,5 GHz	1130.3240.27	1 S	A160	x
150	MW-CONVERTER UNIT 46 GHz	1130.3840.46	1 S	A160	x
160	Air cover	1129.9355.00	2 S		
161	Air cover	1129 9355.00	1 S		
170	Rear panel	1129.9149.00	1 S		
180	DIN6900-M2,5X6 -A2	1148.3059.00	6 S		
190	Cover 9-pin SUB-D	1093.8990.00	1 S		
200	Cover 25-pin SUB-D	1093.9000.00	2 S		
210	Cover RD11,1/9,9	0009.9217.00	5 S		
220	Cover f. LAN-connector	0852.0467.00	2 S		
225	Cover f. IEC-BUS	0852.0450.00	1 S		
230	ADAPTER	1093.9122.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
231	CABLE 2xRJ45	1066.1899.00	1 S		
240	Instrument top cover	1129.9261.00	1 S		
250	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
260	DIN965-M2,5X6-A4-PA	1148.3288.00	10 S		
270	Printed front panel FSU3	1166.1690.00	1 S		
280	Printed front panel FSU8	1129.9210.00	1 S		
290	Printed front panel FSU26	1129.9226.00	1 S		
292	Printed front panel FSU46	1129.9232.00	1 S		
295	RF-cable W1 8GHZ	1129.9503.00	1 S	W1	x
315	TESTPORT GEH. ADAPTER	1021.0493.00	1 S	X1	x
316	RF-CABLE W1 26.5GHZ	1129.9555.00	1 S	W1	x
320	TESTPORT GEH. ADAPTER	1036.4702.00	1 S	X1	x
322	RF-CABLE W1 46GHZ	1129.9590.00	1 S	W1	x
330	Assembly plate	1093.4750.00	1 S		
340	Assembly plate	1093.4772.00	1 S		
350	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
410	BW2-HOUSING 4E1/1T450 FSU	1166.1760.00	1 S		
420	BW 2 - front handle 4U	1096.1480.00	2 S		
430	Screw M4X14	1096.4909.00	4 S		
450	BW2-rear panel foot 50MM	1096.2493.00	4 S		
455	BW2-foil f. rear panel foot	1096.2435.00	1 S		
Document 1166.1677.01 (Basic unit)					
500	Instrument frame 2	1155.5576.00	1 S		
510	MOTHERBOARD	1166.1990.02	1 S	A10	x
520	DIN6900-M2,5X6 -A2	1148.3059.00	7 S		
530	Locking bolt M3	0009.6501.00	4 S		

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
540	Locking bolt H=4,5-40	1093.9180.00	2 S		
550	Power supply unit 230W	1091.2320.00	1 S	A20	x
560	DIN6900-M2,5X6 -A2	1148.3059.00	10 S		
571	FMR 6/5	1091.2520.00	1 S	A90	x
581	BIOS to FMR6	1155.5482.00	1 S		
590	DIN6900-M2,5X6 -A2	0071.5040.00	10 S		
600	Display unit	1093.4708.03	1 S		
601	Display unit	1093.4708.05	1 S		
610	DIN965-M2,5X6-A4-PA	1148.3059.00	4 S		
621	Keyboard frame	1093.5127.00	1 S		
631	Keyboard mat	1093.5133.00	1 S	A16	x
641	Keyboard membrane	1093.5140.00	1 S	A15	x
650	Rotary knob RD28 ACHS-RD6	0852.1086.00	1 S		
660	DIN965-M2X6-A4-PA	0041.1599.00	10 S		
670	3,5" FLOPPY DRIVE STD.	0048.4935.00	1 S	A30	x
680	Floppy bracket	1129.9161.00	1 S		
690	W300 CABLE FLOPPY DATA	1129.9726.00	1 S	W300	
691	CABLE FLOPPY POWER	1129.9732.00	1 S	W301	
700	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
702	DIN6900-M3,0X6 -A2	0041.1682.00	3 S		
705	Floppy cable clamb	1130.1748.00	1 S		
706	DIN6900-M2,5X6 -A2	1148.3059.00	1 S		
710	Harddisk with software FSU	1130.1948.00.	1 S	A60	x
720	Ribbon cable	1093.5156.00	1 S	W29	
730	Disk bracket	1093.4837.00	1 S		
740	DIN965-M2,5X6-A4-PA	0852.3614.00	2 S		
750	DIN965-M3X5-A4-PA	0396.8023.00	4 S		

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
776	LITHIUM-BATTERIE CR2032	0858.2049.00	1 S		
Document 1093.4708.01 Page 4 (Display unit)					
805	Assembly tray	1129.9426.00	1 S		
810	Shielded filter plate	1091.2014.00	1 S		x
820	RF spring (177)	1069.3011.00	2 S		
830	RF spring (137)	1069.3105.00	2 S		
840	Plate holder	0852.0844.00	4 S		
850	DIN965-M2X4-A4-PA	1148.3259.00	4 S		
865	Dust sealing	1129.9449.00	1 S		
871	VNR-08C351-INVERTER	0048.8760.00	1 S	T10	x
880	DIN7985-M2X10-A4-PA	0396.8175.00	2 S		
890	DIN125-A2,2-HP	0049.7396.00	2 S		
892	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
910	Spin wheel	0852.1170.00	1 S	B10	x
915	Screw for plastic material 1.8x4,4	1066.2066.00	3 S		
921	TFT DISPLAY 8.4 INCH 800x600x3	1148.3059.00	1 S	A70	x
930	DIN6900-M2,5X6 -A2	0071.5040.00	4 S		
932	Space	1129.9432.00	4 S		
934	DIN965-M2,5X5-A4-PA	0852.3608.00	4 S		
948	Display cable TOSHIBA FMR6	1091.2666.00	1 S	W70	x
949	Display connector TOSHIBA FMR6	1091.2637.00	1 S	W71	x
950	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
960	Slip on spring	1166.1783.00	1 S		
Document 1144.9017.00 (Option FSU-B4 1144.9000.02)					
1100	OCXO	1093.7871.03	1 S	A200	x
1120	RF-cable W21	1129.9926.00	1 S	W21	
Document 1162.9921.00 (Option FSP-B28 1162.9915.02)					
1360	USER-PORT CABLE W67	1142.8094.00	1 S	W67	x

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
1365	Locking bolt M3	0009.6501.00	2 S		
1370	DIN137-A3-A2	0005.0296.00	2 S		
1375	DIN934-M3-A4	0016.4398.00	2 S		
1380	Adhesive shield	1162.9938.00	1 S		
Document 1144.9300.00 (Option FSU-B25 1144.9298.02)					
1400	ATTENUATOR (PARTLY ELECTRICAL)	1108.7230.02	1 S	A50	x
1410	Ribbon cable 10 POL	1129.7823.00	1 S		
1420	RF-CABLE W 27	1144.9330.00	1 S		
1425	RF-CABLE W27 (26,5 GHz)	1144.9323.00	1 S		
1430	RF-CABLE W28 (RF-CON)	1144.9346.00	1 S		
1440	RF-CABLE W28 (MW-CON)	1144.9352.00	1 S		
1460	DIN6900-M2,5X8 -A2	0071.5705.00	4 S		
Document 1145.0259.00 (Option FSU-B18 1145.0242.04)					
1500	MULTI-PURPOSE DRIVE (FLOPPY, PCMCIA)	1080.4140.03	1 S	A381	x
1505	HOLDER FOR MULTI-PURPOSE DRIVE	1129.9484.00	1S		
1506	DIN6900-M3,0X6 -A2	0071.6847.00	3 S		
1510	PCMCIA HARDDISK WITH SOFTWARE	1145.0407.04	1 S	A380	x
1550	CABLE W300 FLOPPY DATA	1145.0265.00	1 S	W300	
1575	CABLE CLAMP	0099.7825.00	2 S		
1576	CABLE CLAMP	0627.2116.00	2 S		
Documnet 1129.7298.00 Page 2 (Option FSP-B10 1129.7246.04)					
1600	EXT. GEN. CONTROL	1093.8590.02	1 S	A210	x
1610	IEC-BUS Cable W21	1129.7252.00	1 S	W21	x
1612	DIN125-A3,2-A4	0082.4670.00	2 S		
1614	DIN137-A3-A2	0005.0296.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
1506	DIN6900-M3,0X6 -A2	0071.6847.00	3 S		
1510	PCMCIA HARDDISK WITH SOFTWARE FSU	1145.0407.02	1 S	A380	x
1510	PCMCIA HARDDISK WITH SOFTWARE FSQ	1145.0407.03	1 S	A380	x
1550	Cable W300 FLOPPY DATA	1145.0265.00	1 S	W300	
1575	CABLE CLAMP	0099.7825.00	2 S		
1576	CABLE CLAMP	0627.2116.00	2 S		
1620	Aux control cable W22	1129.7269.00	1 S	W22	x
1622	Locking bolt M3	0009.6501.00	2 S		
1624	DIN137-A3-A2	0005.0296.00	2 S		
1626	DIN934-M3-A4	0016.4398.00	2 S		
Document 1155.1612.00 (Option FSU-B20 1155.1606.04)					
1700	COMPACT FLASH BOARD	1130.3557.02	1 S	A60	
1715	FLASH MEMORY CARDS MIT SOFTWARE	1155.1641.04	1 S	A61/A62	x
1730	PCB holder clamp	1130.1260.00	2 S		
1740	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
Document 1142.9090.00 (Option FSU-B9 Tracking Generator 1142.8994.02)					
1800	Tracking Generator	1130.3605.02	1 S	A170	x
1810	RF-CABLE W41	1142.9003.00	1 S	W41	
1820	RF-CABLE W42 (RF-Con)	1142.9010.00	1 S	W42	
1830	RF-CABLE W42 (8GHz)	1142.9026.00	1 S	W42	
1840	RF-CABLE W43	1142.9032.00	1 S	W43	
1850	RF-CABLE W44	1142.9049.00	1 S	W44	
1860	RF-CABLE W45	1142.9055.00	1 S	W45	
1870	RF-CABLE W46	1142.9061.00	1 S	W46	
1880	RF-CABLE W47	1142.9078.00	1 S	W47	
1890	RF-CABLE W48	1142.9084.00	1 S	W48	
1895	ADAPTOR	0343.0257.00	1 S	X2	x

1900	MOUNTING PLATE	1093.4750.00	1 S		
1910	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
1920	LABEL FSU-B9 FRONT	1142.9132.00	1 S		
1930	LABEL FSU-B9 REAR	1142.9126.00	1 S		
Document 1130.2544.01 (Converter Unit 8GHz)					
2000	8 GHZ CONVERTER	1130.2550.02	1 S	A160	x
2005	YIG-UNIT 8GHz (MICRO LAMBDA)	1130.2944.02	1 S	A161	x
2010	YIG-UNIT 8GHz (FILTRONIC)	1130.2944.03	1 S	A161	x
2025	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
2030	DIPLEXER 8GHZ	1132.6501.02	1 S	A162	x
2035	DIN6900-M2,5X5 -A2	0071.6830.00	4 S		
Document 1130.3240.01 Blatt 1 (MW-Converter Unit 26.5 GHz)					
2100	26 GHz CONVERTER	1130.3257.02	1 S	A160	x
2105	DIPLEXER26	1151.3010.02	1 S	A161	x
2106	DIPLEXER 26 (OPTION B23)	1151.5520.23	1 S	A161	x
2110	DIN6900-M2,5X6 -A2	1148.3059.00	4 S		
2114	YIG UNIT (FILTRONIC)	1130.3492.26	1 S	A162	x
2115	YIG UNIT (MICRO LAMBDA)	1130.3311.26	1 S	A162	x
2118	YIG UNIT (FILTRONIC)	1130.3492.28	1 S	A162	x
2119	YIG UNIT (MICRO LAMBDA)	1130.3311.28	1 S	A162	x
2120	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
2125	EXTENDER 26	1132.8504.02	1 S	A163	x
2130	DIN6900-M2,5X6 -A2	1148.3059.00	7 S		
2135	RF-CABLE W3	1130.3340.00	1 S		
2140	RF-CABLE W4	1130.3357.00	1 S		
2145	RF-CABLE W5	1130.3363.00	1 S		
2150	HOLDER LO CABLE	1130.3292.00	1 S		
2155	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2160	Cover B side	1130.3270.00	1 S		
2165	Cover A side	1130.3286.00	1 S		
2225	SMA	1066.2095.00	1 S		
Document 1142.9361.00 (Option FSU-B12 Tracking Attenuator 1142.9349.02)					
2400	STEP ATTENUATOR (FSU-B12)	1067.8380.04	1 S	A171	x
2400	ATTENUATOR HOLDER	1129.9455.00	1 S		
2415	DIN6900-M3x8-A2	0071.6853.00	2 S		
2420	DIN6900-M2,5x6-A2	1148.3059.00	3 S		
2430	RF CABLE W41	1142.9378.00	1 S	W41	
2440	RF CABLE W49	1142.9384.00	1 S	W49	
2445	ADAPTER CABLE	1142.9390.00	1 S		
Document 1130.3840.01 (MW-Converter Unit 46 GHz)					
2500	46 GHz CONVERTER	1130.3857.02	1 S	A160	x
2510	DIPLEXER 46	1162.1120.02	1 S	A161	x
2520	DIN6900-M2,5X6 -A2	1148.3059.00	4 S		
2530	YIG UNIT 46 GHz	1130.3963.46	1 S	A162	x
2540	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
2550	EXTENDER 46	1151.6010.02	1 S	A163	x
2560	DIN6900-M2,5X6 -A2	1148.3059.00	6 S		
2570	HOLDER LO CABLE	1130.3292.00	1 S		
2580	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
2590	RF-CABLE W3	1130.3892.00	1 S		
2600	RF-CABLE W4	1130.3905.00	1 S		
2610	RF-CABLE W5	1130.3911.00	1 S		
2620	RF-CABLE W6	1130.3928.00	1 S		
2630	SMA	1066.2095.00	1 S		
2640	COVER B- side	1130.3870.00	1 S		
2650	COVER A- side	1130.3886.00	1 S		
2695	MW-CON46 foil	1130.3940.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
Document 1157.1110.00 (Option FSU-B21 1157.1090.02)					
2900	EXT MIXER	1157.1126.02	1 S	A180	x
2910	RF-CABLE W36	1157.1178.00	1 S	W36	x
2920	RF-CABLE W37	1157.1184.00	1 S	W37	x
2930	RF-CABLE W38	1157.1190.00	1 S	W38	
2940	RF-CABLE W39	1157.1203.00	1 S	W39	
2942	RF-CABLE W39	1157.1232.00	1 S	W39	
2950	HOLDER EXT MIXER	1157.1103.00	1 S		
2960	DIN965-M2,5X6-A4-PA	1148.3288.00	2		

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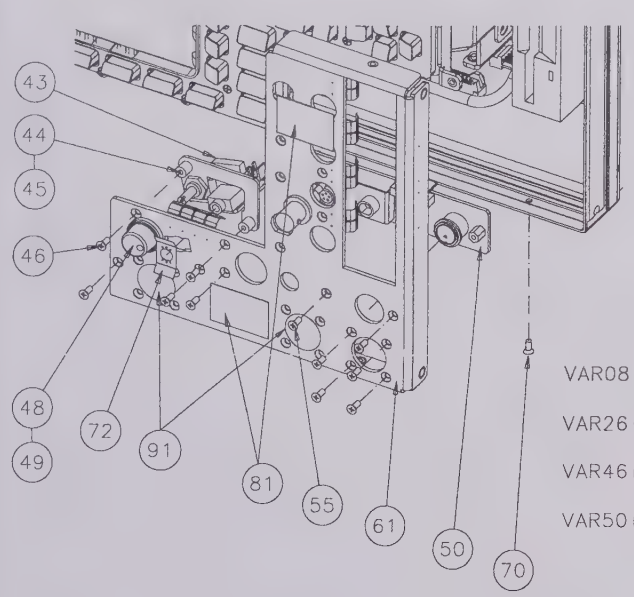
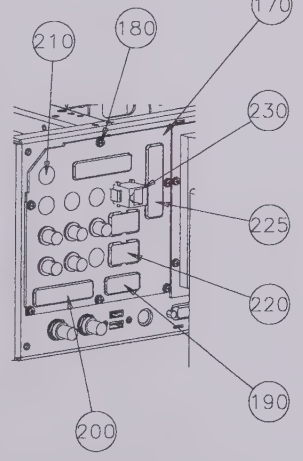
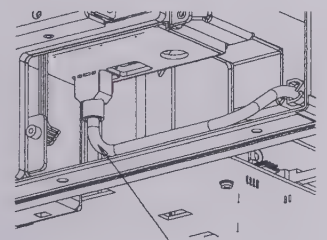
Ansicht A
View A

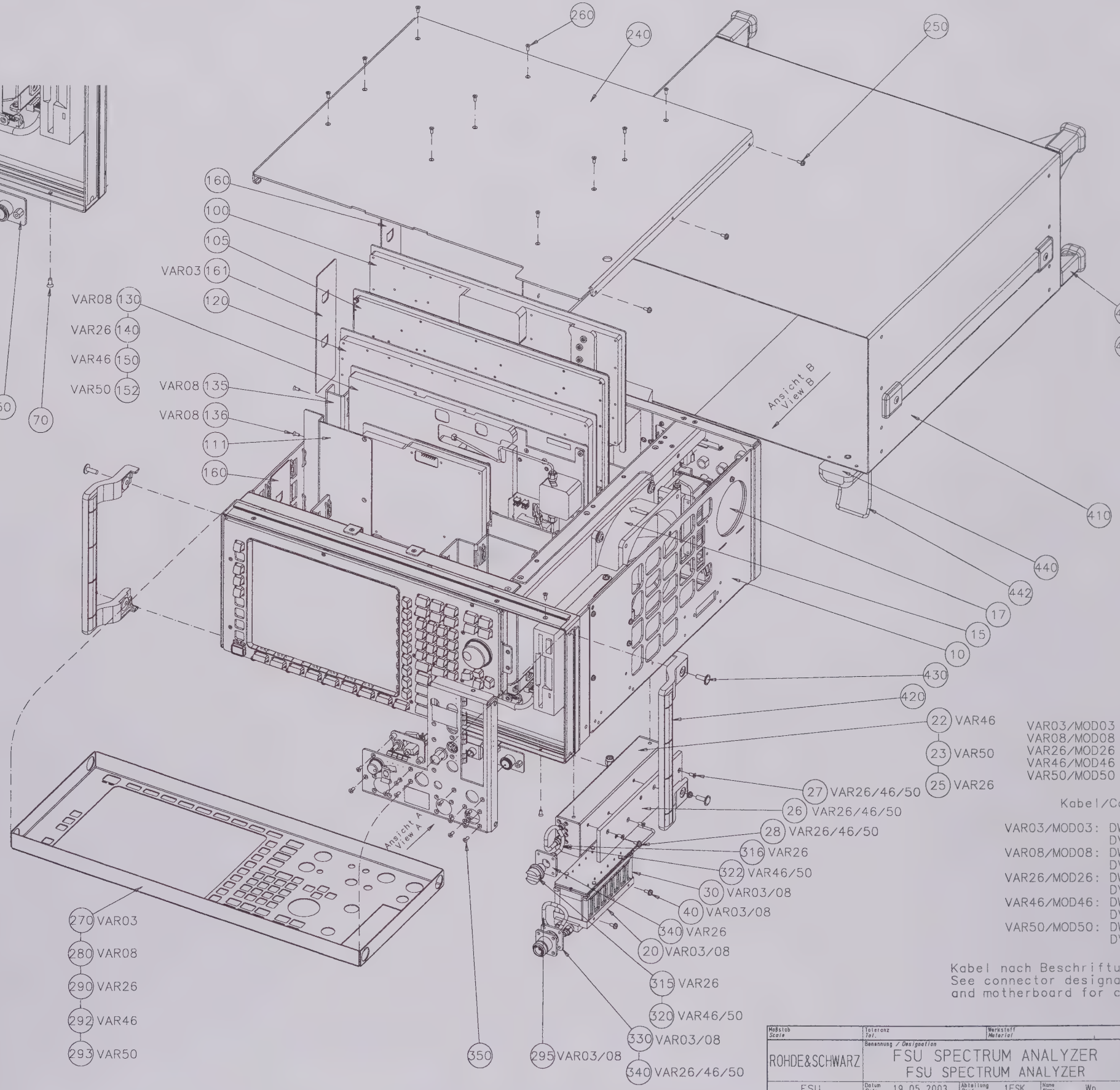


Ansicht B
View B



Ansicht C
View C





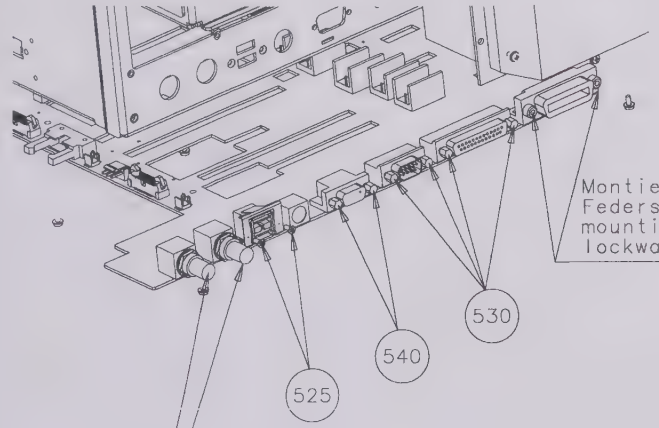
VAR03/MOD03 = FSU 3,6GHz
VAR08/MOD08 = FSU 8GHz
VAR26/MOD26 = FSU 26,5GHz
VAR46/MOD46 = FSU 46GHz
VAR50/MOD50 = FSU 50GHz

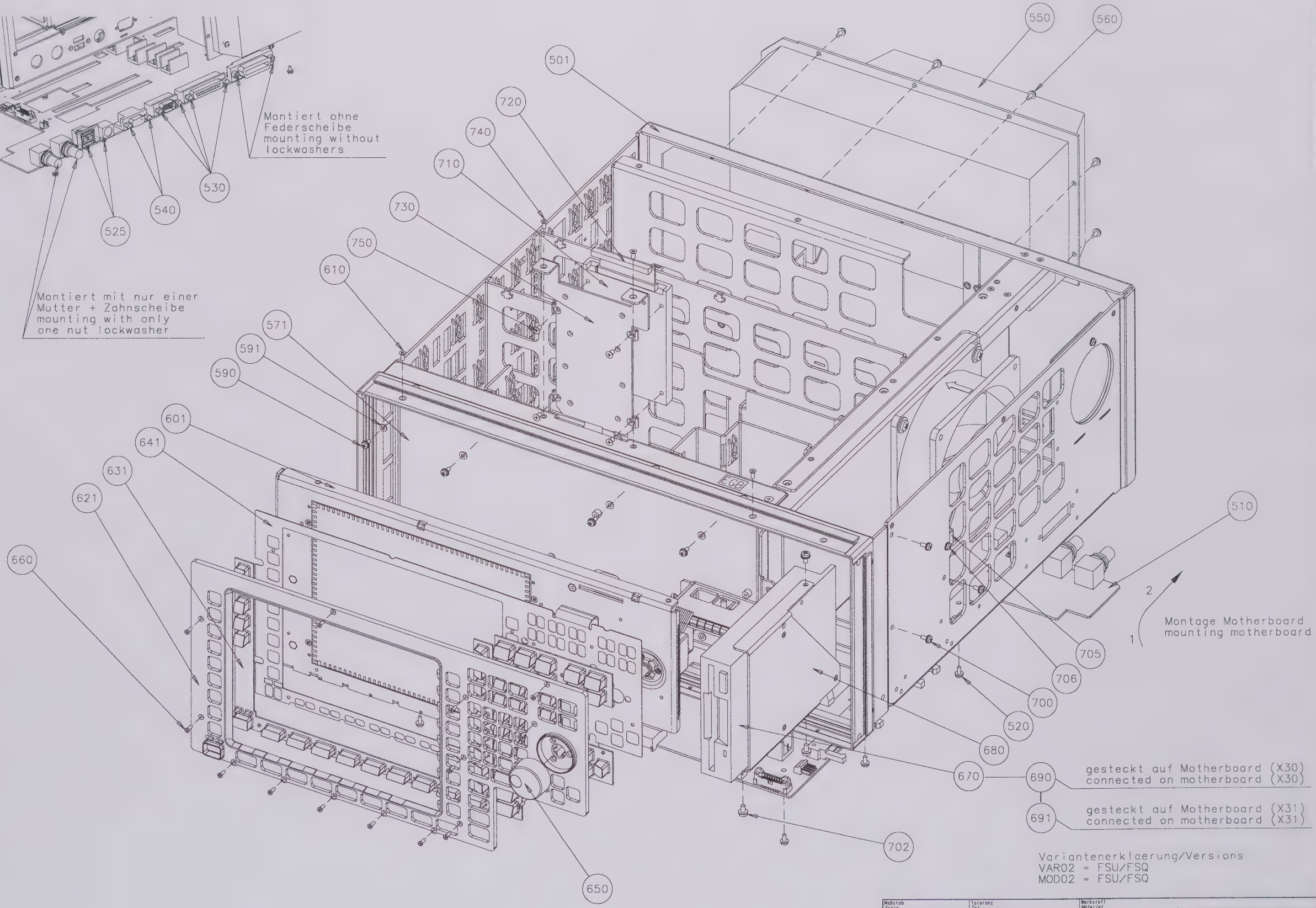
Kabel/Cable:

VAR03/MOD03:	DW	1129.9490.03
	DV	1129.9749.03
VAR08/MOD08:	DW	1129.9490.08
	DV	1129.9749.08
VAR26/MOD26:	DW	1129.9490.26
	DV	1129.9749.26
VAR46/MOD46:	DW	1129.9490.46
	DV	1129.9749.46
VAR50/MOD50:	DW	1129.9490.46
	DV	1129.9749.46

Kabel nach Beschriftung montieren.
See connector designation of cables and motherboard for cable mounting.

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER		Sprache / Lang.: de en; Ausf. / C.I.: 01.00; Blatt / Sh.: 1	
FSU	Datum / Date: 19.05.2003; Abteilung / Dept.: 1ESK; Name: Wn		Zeichn.Nr. / Drawing No.: 1166.1660.01	D





Variantenerklaerung/Versions
VAR02 = FSU/FSQ
MOD02 = FSU/FSQ

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Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation	GRUNDEINHEIT Basic Unit		Sprache / Lang. de en	Ast / C.I. 01.00	Blatt / Sh. 1
Typ / Type FSU				Zeichn Nr / Drawing No 1166.1677.01		D
1.Z. / used in	Datum / Date 22.05.2003	Abteilung / Dept. 1ESK	Name / Name Wn			

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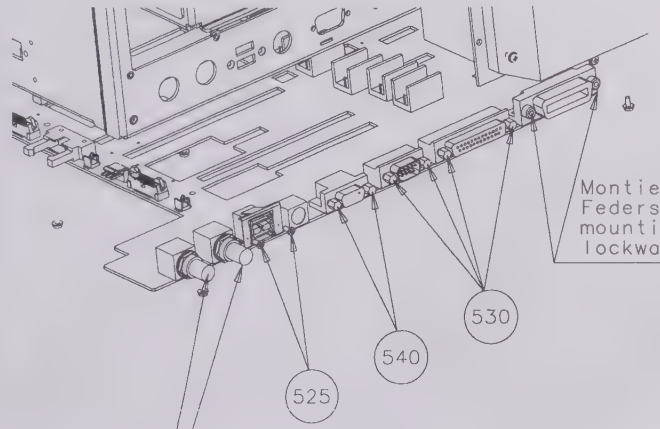

Montiert ohne Federscheibe
mounting without lockwashers

Montiert mit nur einer Mutter + Zahnscheibe
mounting with only one nut lockwasher

501
720
740
710
730
750
610
571
591
590
601
641
631
621
660
650
550
560
510
705
706
700
520
680
670
690
691
702

2
1
Montage Motherboard
mounting motherboard

gesteckt auf Motherboard (X30)
connected on motherboard (X30)

gesteckt auf Motherboard (X31)
connected on motherboard (X31)

Variantenerklaerung/Versions
VAR02 = FSU/FSQ
MOD02 = FSU/FSQ

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: GRUNDEINHEIT / Basic Unit			Sprache / Lang.: de en	Ausl. / C.I.: 01.00	Blatt / Sh.: 1
Typ / Type: FSU				Zeichn.Nr. / Drawing No.: 1166.1677.01		D
1.Z. used in	Datum / Date: 22.05.2003	Abteilung / Dept: 1ESK	Name / Name: Wn			

Projektionsmethode / Projection Method

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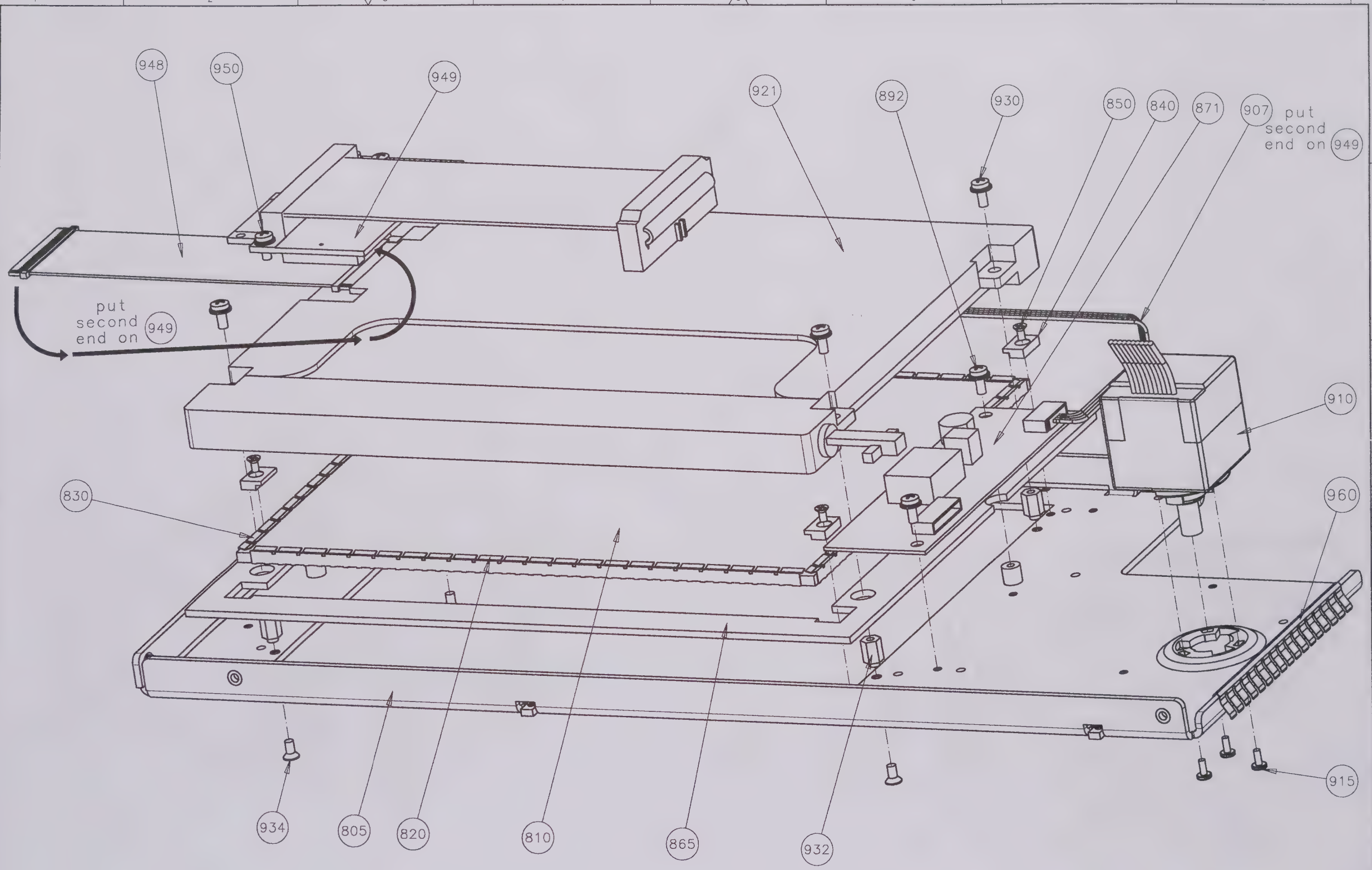

MOD 05 = Display Toshiba LTM 08C351 for FSU/FSQ with FMR6

Maßstab / Scale 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: DISPLAYEINHEIT / DISPLAY UNIT			Sprache / Lang. de en	Aei. / C.I. 08.00	Blatt / Sh. 4
Typ / Type				Zeichn.Nr. / Drawing No. 1093.4708.01		D
1.Z. / used in 1129.9090.01	Datum / Date 24.03.2003	Abteilung / Dept. 1ESK	Name / Name TF			

Projektionsmethode / projection Method

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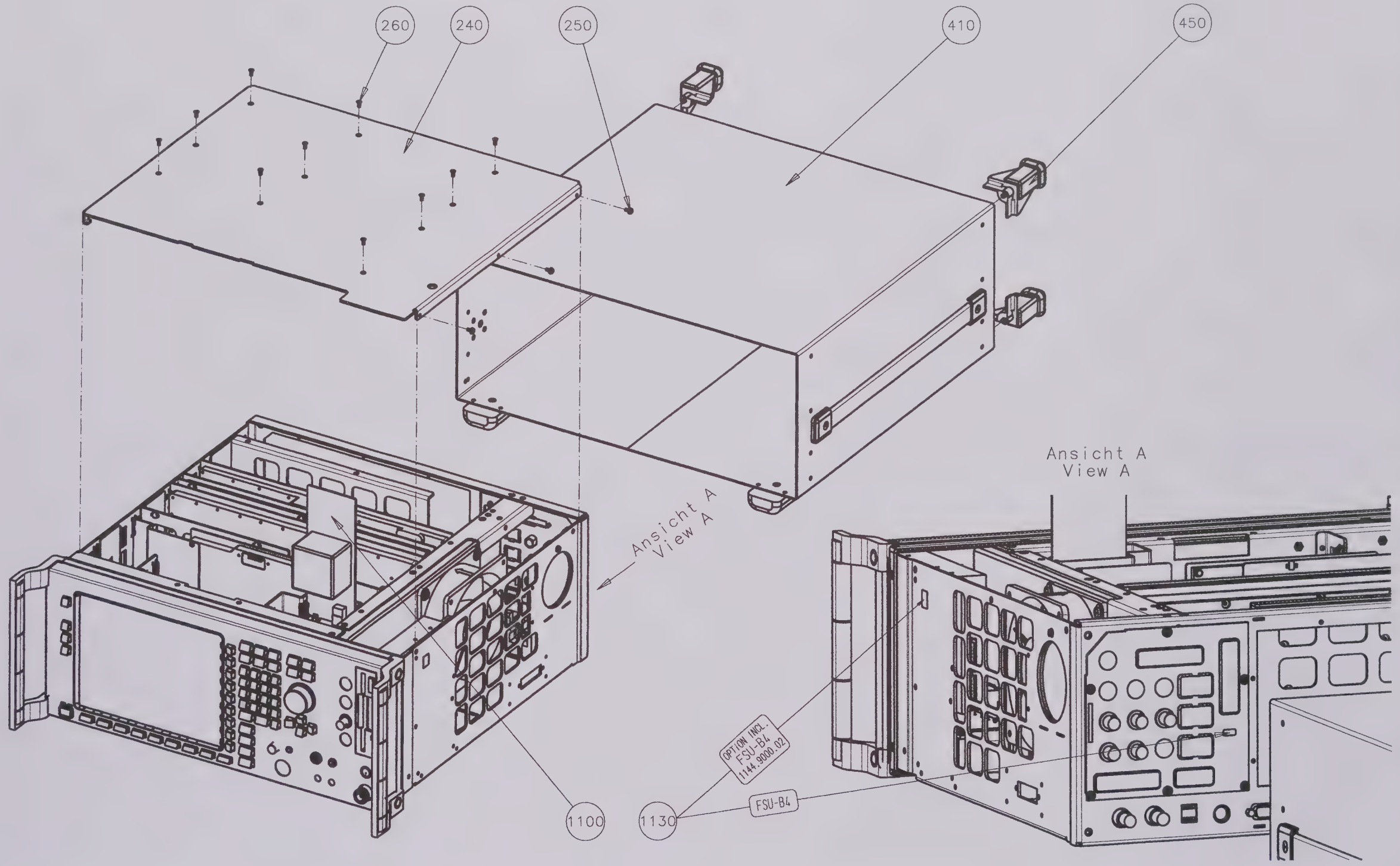

Kabel nach Beschriftung montieren.
See connector designation of cables and motherboard for cable mounting.

Maßstab / *Scale*	Toleranz / *Tol.*	Werkstoff / *Material*			
ROHDE&SCHWARZ	Benennung / *Designation*	Einbauanweisung FSU-B4 Installation Instruction		Sprache / *Lang.* de en	Aei. / *C.I.* 02.00	Blatt / *Sh.* 1
Typ / *Type* FSU-B4				Zeichn.Nr. / *Drawing No.* 1144.9017.00		D
1.Z. / *used in* 1144.9000.01	Datum / *Date* 24.11.2000	Abteilung / *Dept.* 1ESK	Name / *Name* TF			

Projektionsmethode / *Projection Method*

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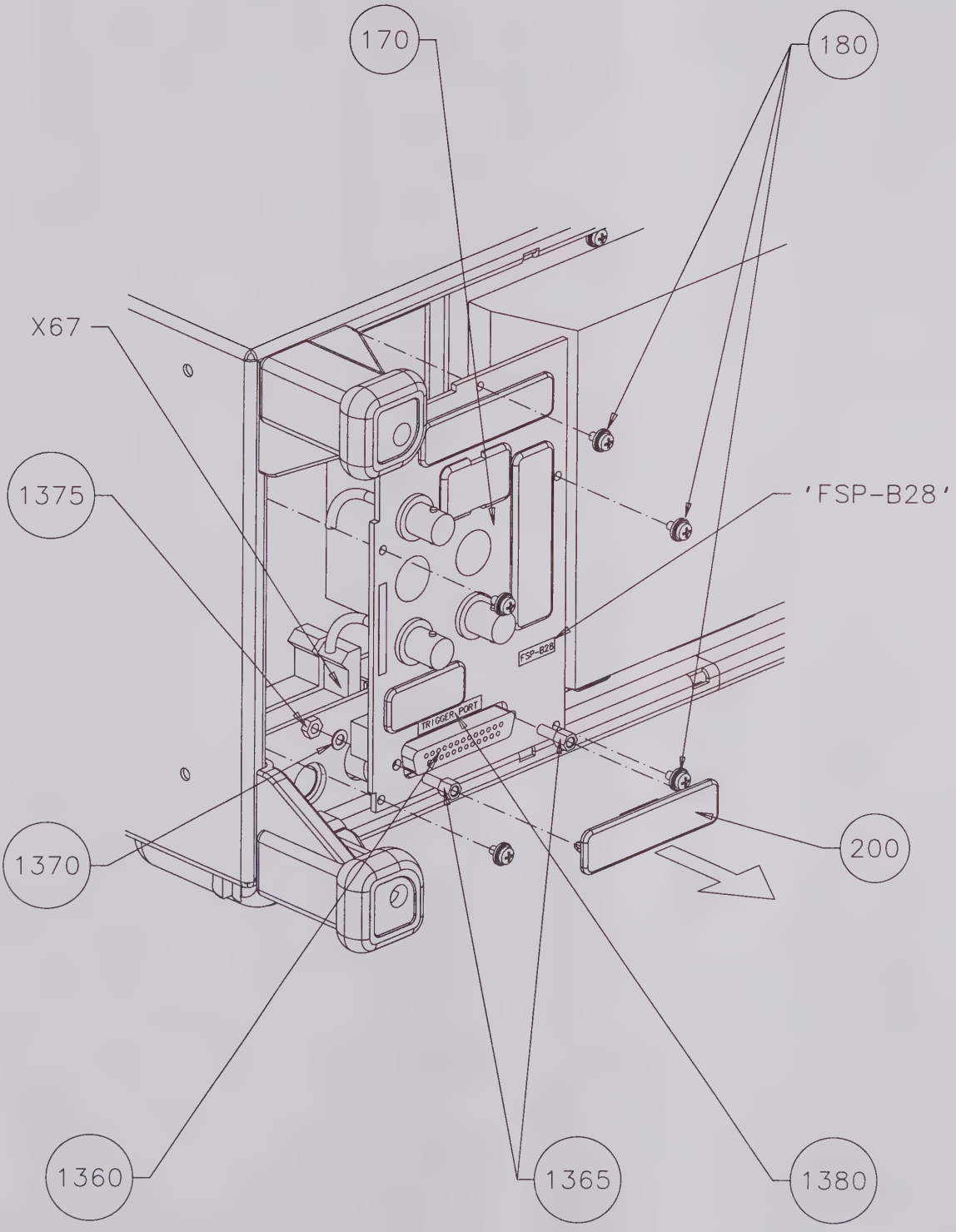


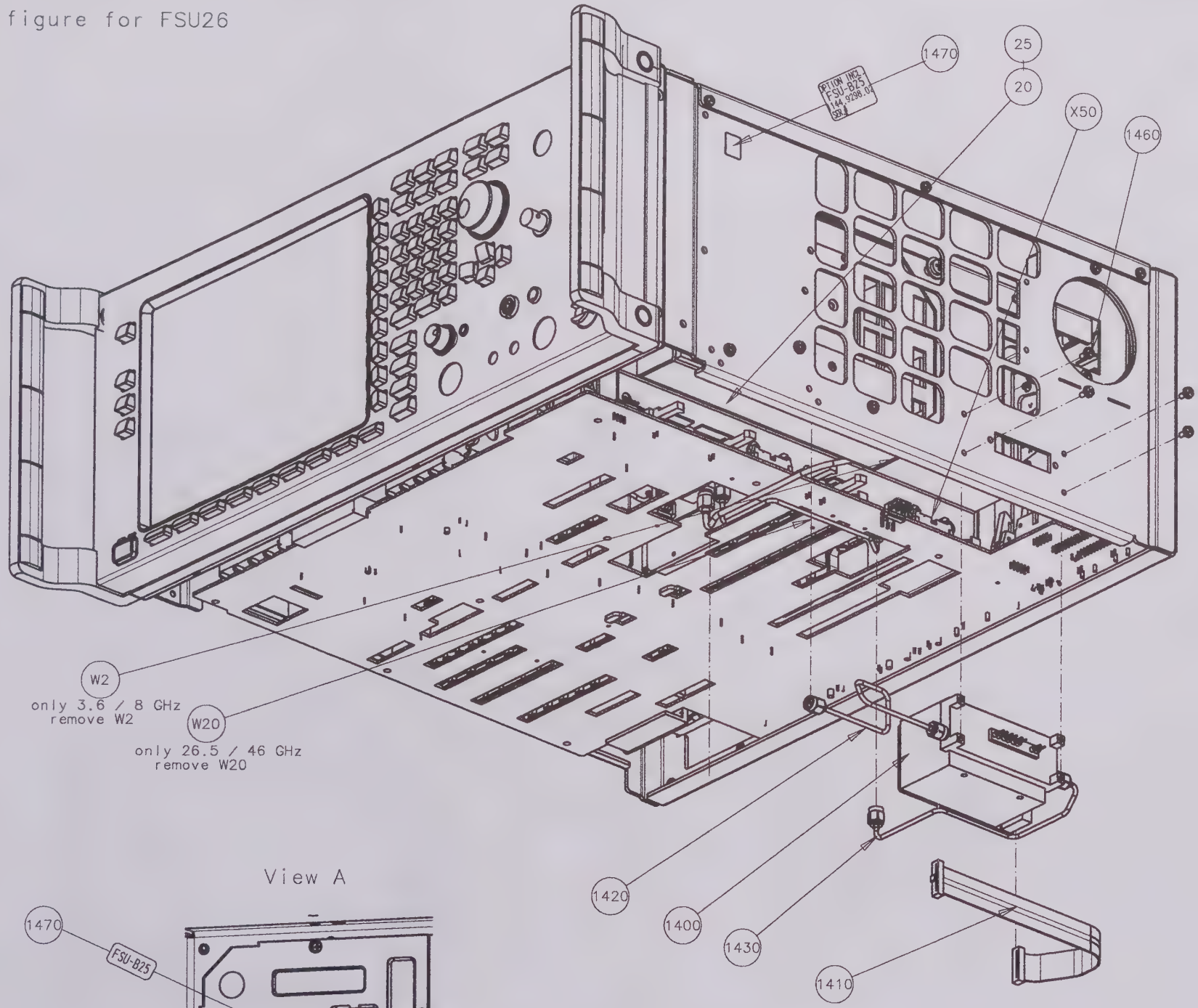
figure for FSP

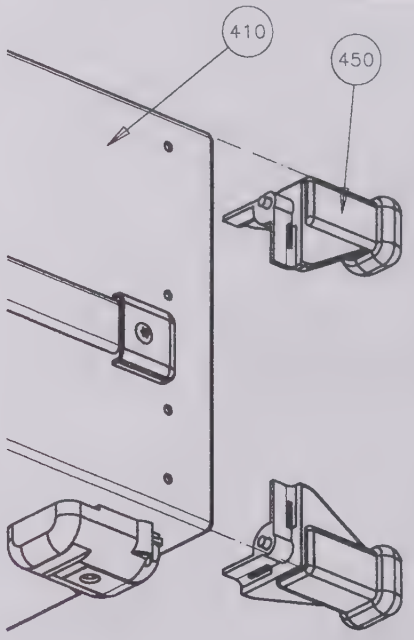
Projektions-methode
Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: Einbauanweisung -B28 / Assembly Instruction			Sprache / Lang.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 1
Typ / Type: FSP-B28				Zeichn.Nr. / Drawing No.: 1162.9921.00 D	
1.Z. used in: 1162.9915.02	Datum / Date: 18.07.2002	Abteilung / Dept.: 1ESK	Name / Name: TF		

1 2 3 4

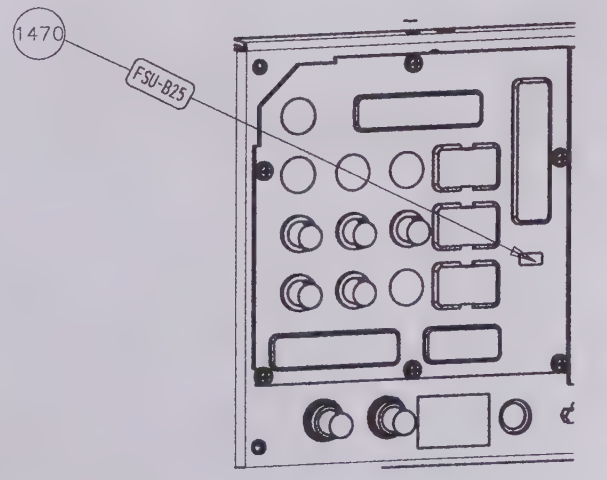
figure for FSU26





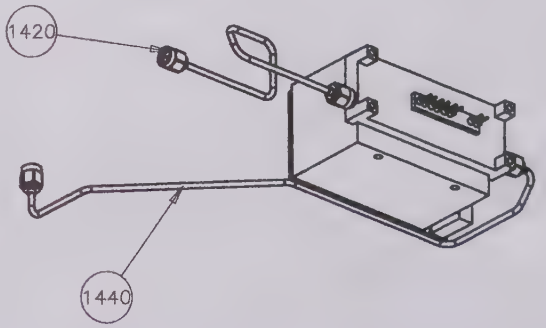
View A

View A

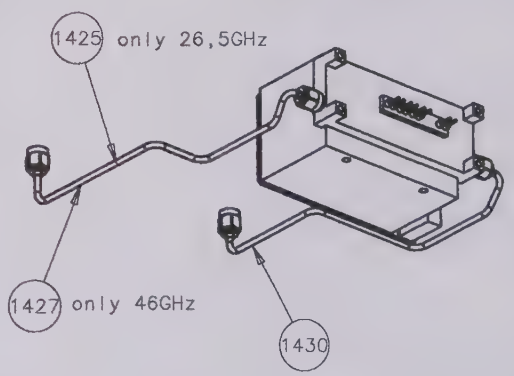


View Attenuator 3,6GHz Units

View Attenuator 8GHz Units



View Attenuator 26,5/46GHz Units



Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material					
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Typ / Type: FSU-B25					Zeichn.Nr. / Drawing No.: 1144.9300.00		D
I.Z. / used in: 1144.9298.01	Datum / Date: 19.02.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn				

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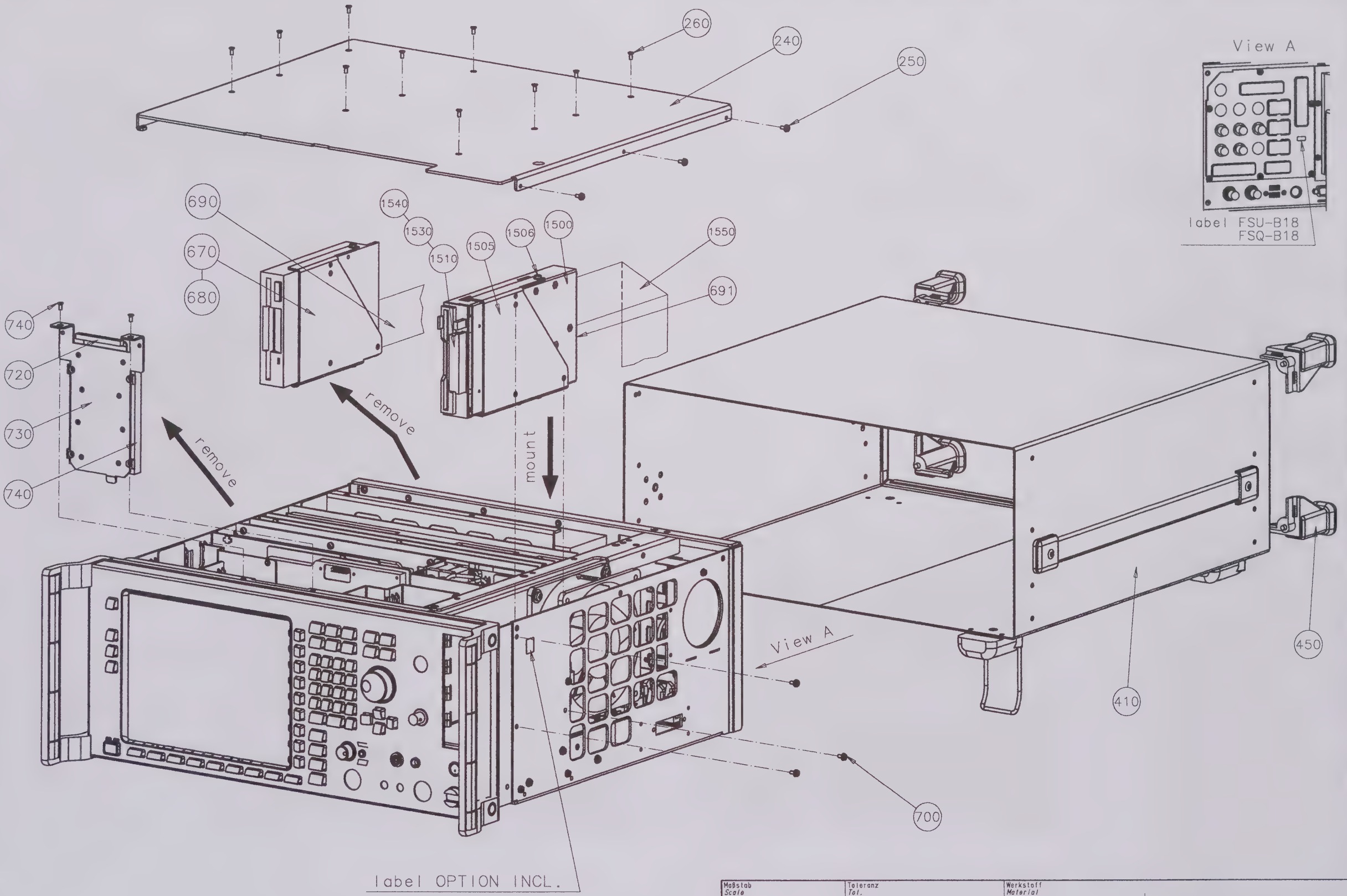
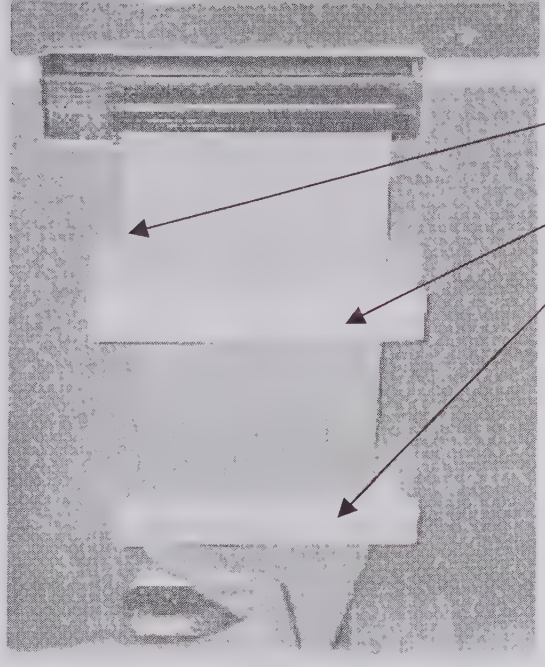
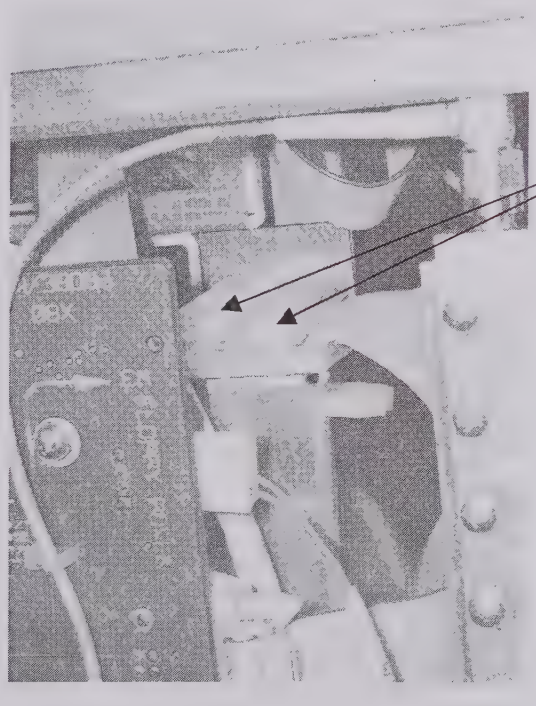


Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			Sprache / Lang.	Aei. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation: Assembly Instruction Assembly Instruction				de en	02.00	1
FSU-B18	Datum / Date 16.10.2003	Abteilung / Dept. 1ESK	Name / Name Wn		Zeichn.Nr. / Drawing No. 1145.0259.00		D





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Maßstab: / *Scale:*	Toleranz: / *Tol.:*	Rauht.: /*Roughn.:*	Kanten: / *Edges:*	Werkstoff: / *Material:*	Werknormen: / *Company Standards:*

ROHDE&SCHWARZ	Benennung: *Designation:* Assembly Instruction			Sprache: / *Lang.:*	Aei: / *C.I.:*	Blatt: / *Sh..*
				de en	01.00	2
Typ *Type.* FSU-B18	Datum: *Date.* 11.02.02	Abteilung: *Dept.:* 1ESK	Name: *Name.* TF	Zeichn. Nr.: / *Drawing Nr.:*		
1 Z *used in*				1145.0259.00		D

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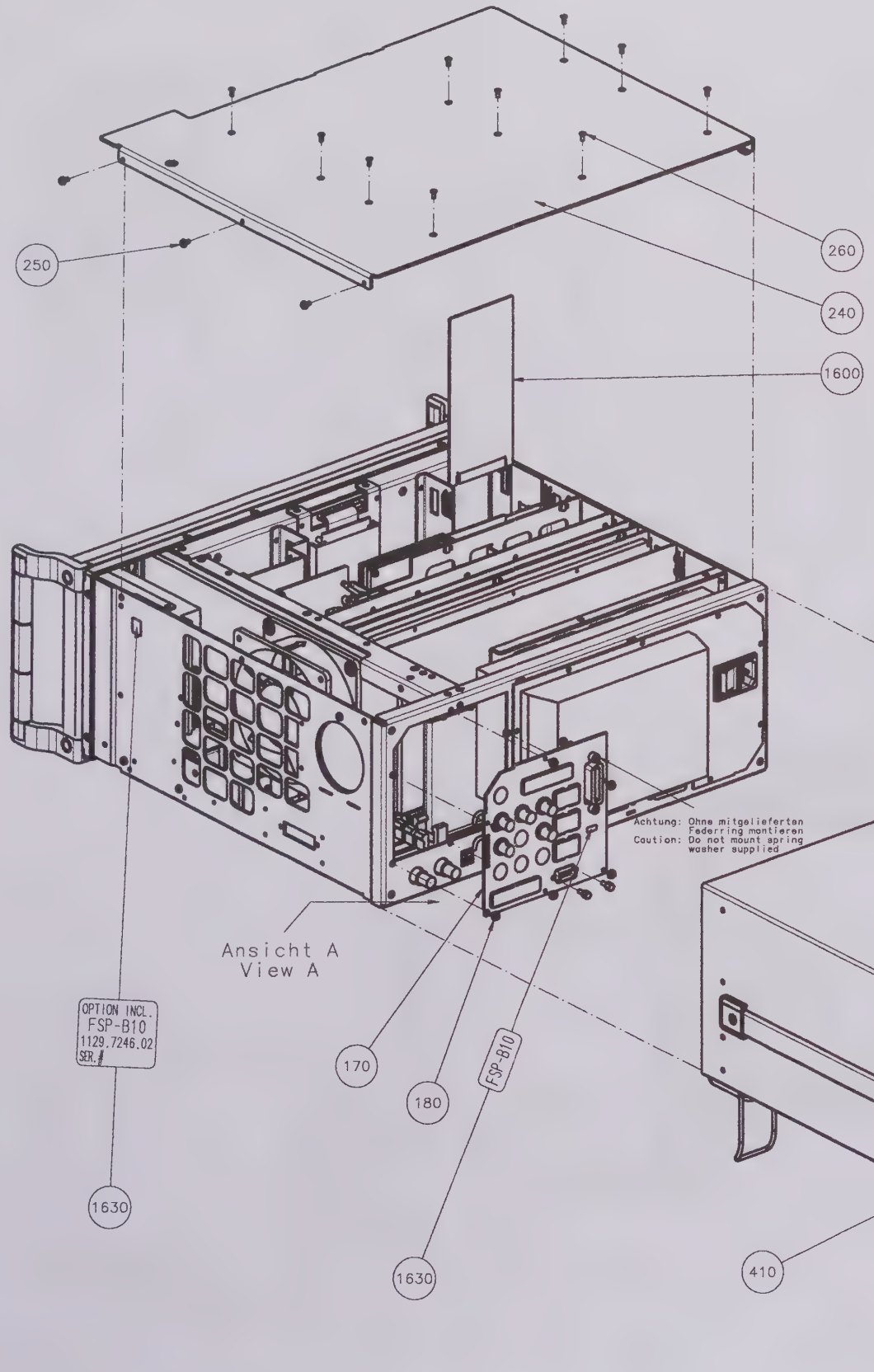

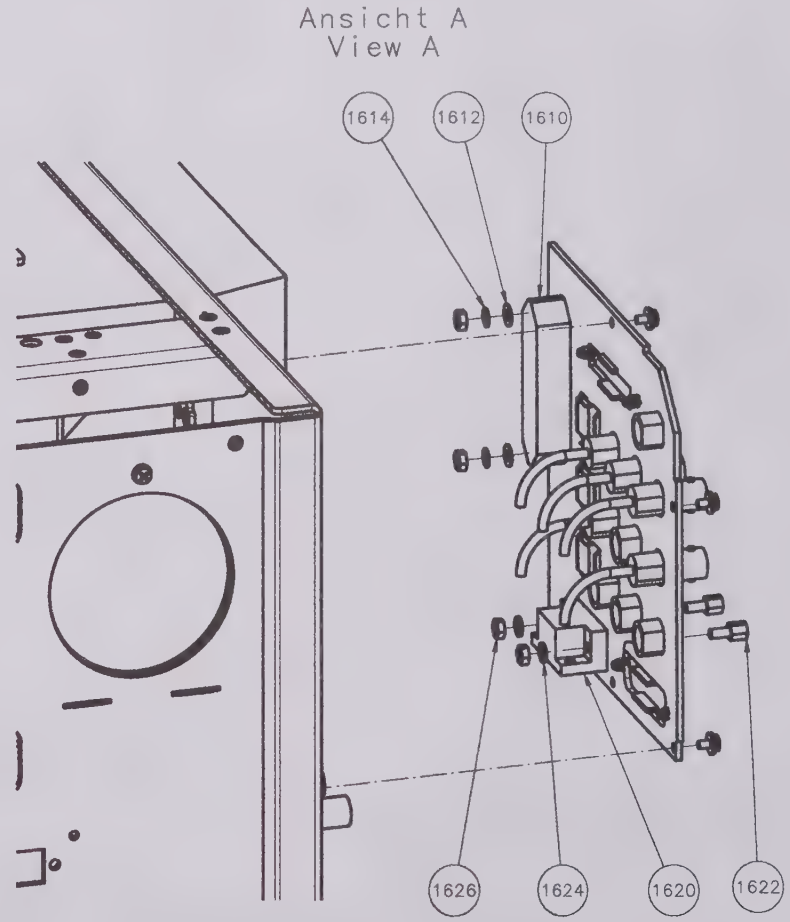

Figure for FSU

Projektions-methode
Projection Method

Maßstab *Scale*	Toleranz *Tol.*	Werkstoff *Material*			
ROHDE&SCHWARZ	Benennung / *Designation*	EINBAUANWEISUNG FSP-B10 INSTALLATION INSTRUCTION		Sprache / *Lang.* de en	Aei. / *C.I.* 04.00	Blatt / *Sh.* 2
Typ *Type* FSU				Zeichn.Nr. / *Drawing No.* 1129.7298.00 D	
i.Z. *used in* 1129.7246.01	Datum *Date* 29.10.2001	Abteilung *Dept.* 1ESK	Name *Name* Wn		

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View A

1700
X61
X63
X62
1730
SYSTEM
DATA
1706 FSP
1708 ESPI
1710 FSU
1712 FSQ

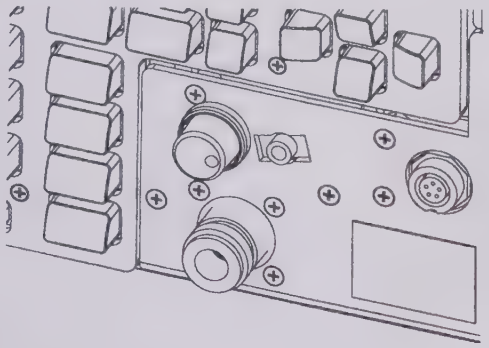
710
remove
remove
750
730
1740
270
600
610
570
571
or
740
720
260
240
250
View A
mount
View B
label FSU-B20
450
410
420
430
1720
only FMR5:
remove all
SDRAMs
label OPTION INCL.
FMR5:
insert the new
SDRAM into the
top slot.
FMR6:
insert the new
SDRAM into the
free slot.

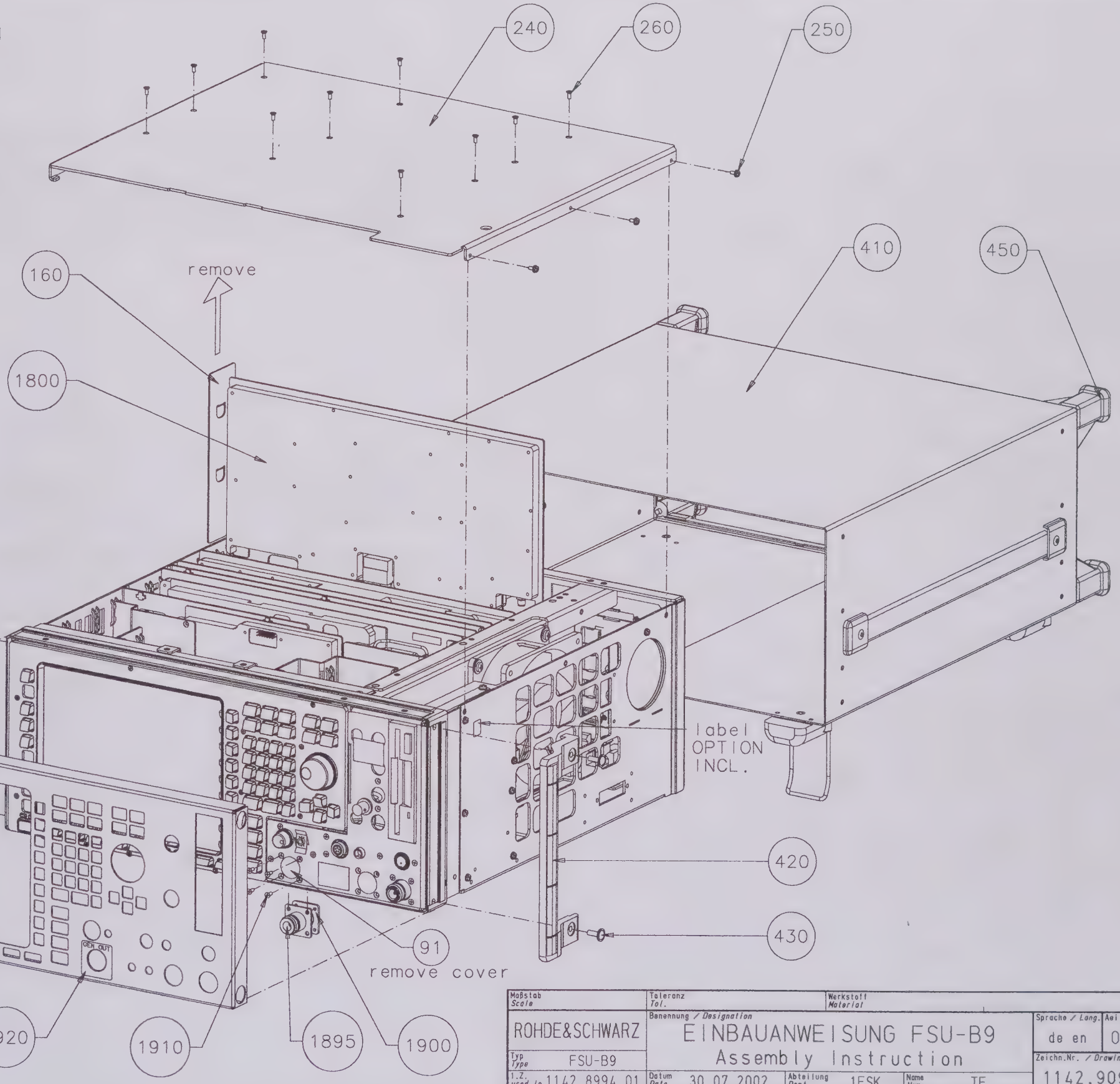
picture FSU

drawing is also
valid for other
units

Maßstab / Scale		Toleranz / Tol.		Werkstoff / Material			
ROHDE&SCHWARZ		Benennung / Designation: Einbauanweisung / Assembly Instruction				Sprache / Lang. de en	Aei. / C.I. 02.00	Blatt / Sh. 1
Typ / Type	FSP-B20					Zeichn.Nr. / Drawing No. 1155.1612.00		D
i.Z. / used in	1155.1606.01	Datum / Date	11.02.2002	Abteilung / Dept.	1ESK	Name	Wn	

detail GEN OUTPUT mounted





Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
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Typ / Type: FSU-B9			Blatt / Sh.: 1
T.Z. / used in: 1142.8994.01	Datum / Date: 30.07.2002	Abteilung / Dept.: 1ESK	Name / Name: TF
		Zeichn.Nr. / Drawing No.: 1142.9090.00	D

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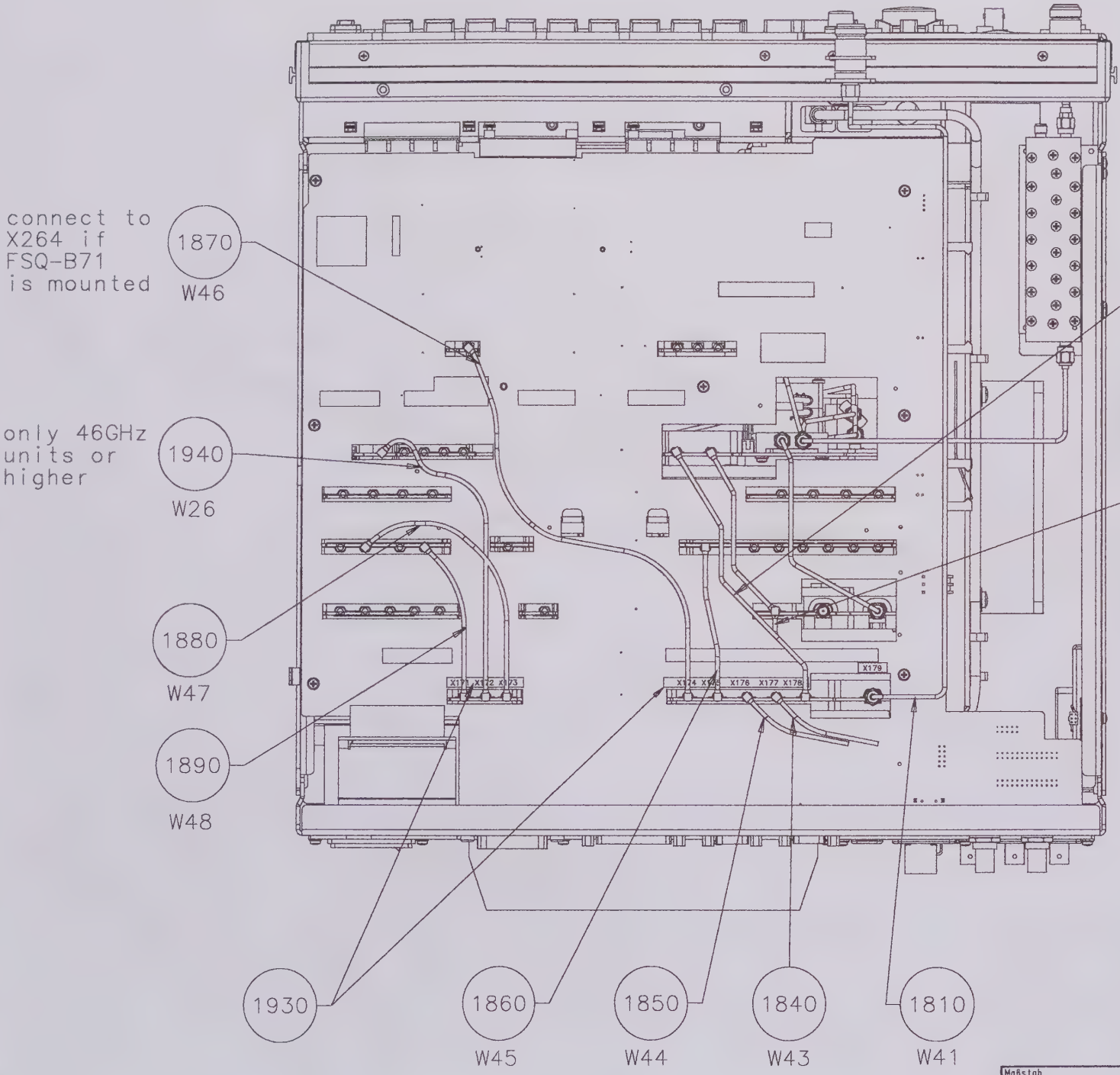

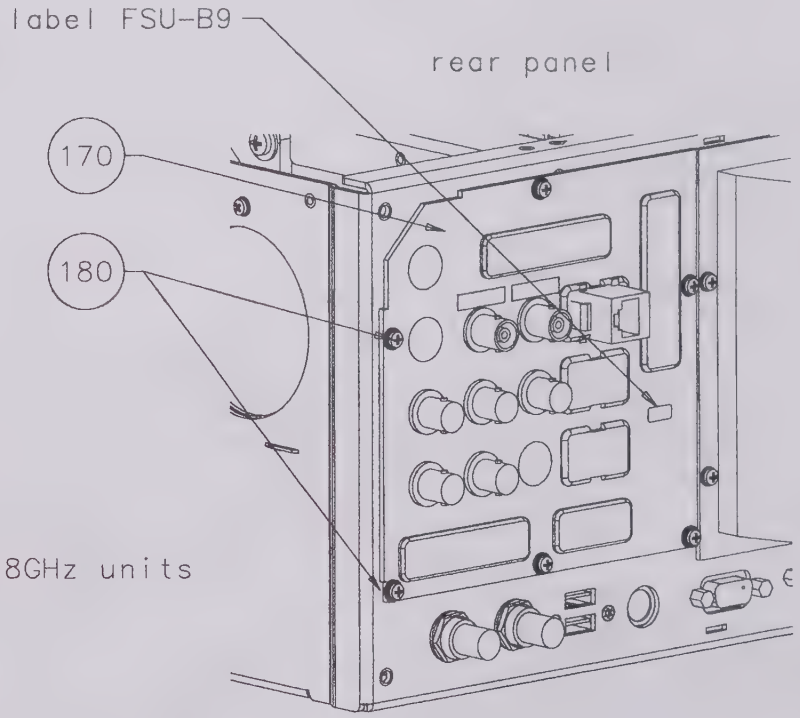

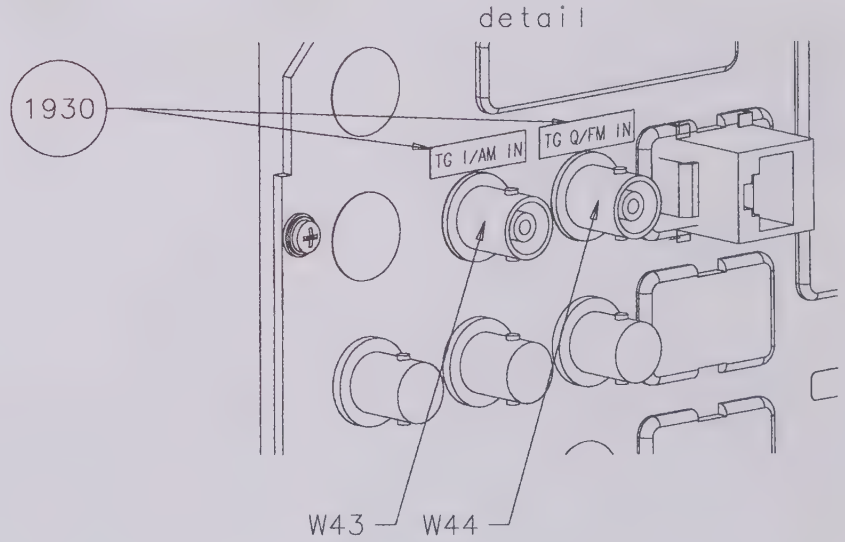

see connector designation of cables and motherboard for cable mounting

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSU-B9 Assembly Instruction			Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 2
Typ / Type: FSU-B9						Zeichn.Nr. / Drawing No.: 1142.9090.00 D
I.Z. / used in: 1142.8994.01	Datum / Date: 26.05.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn			

Projektionsmethode / Projection Method

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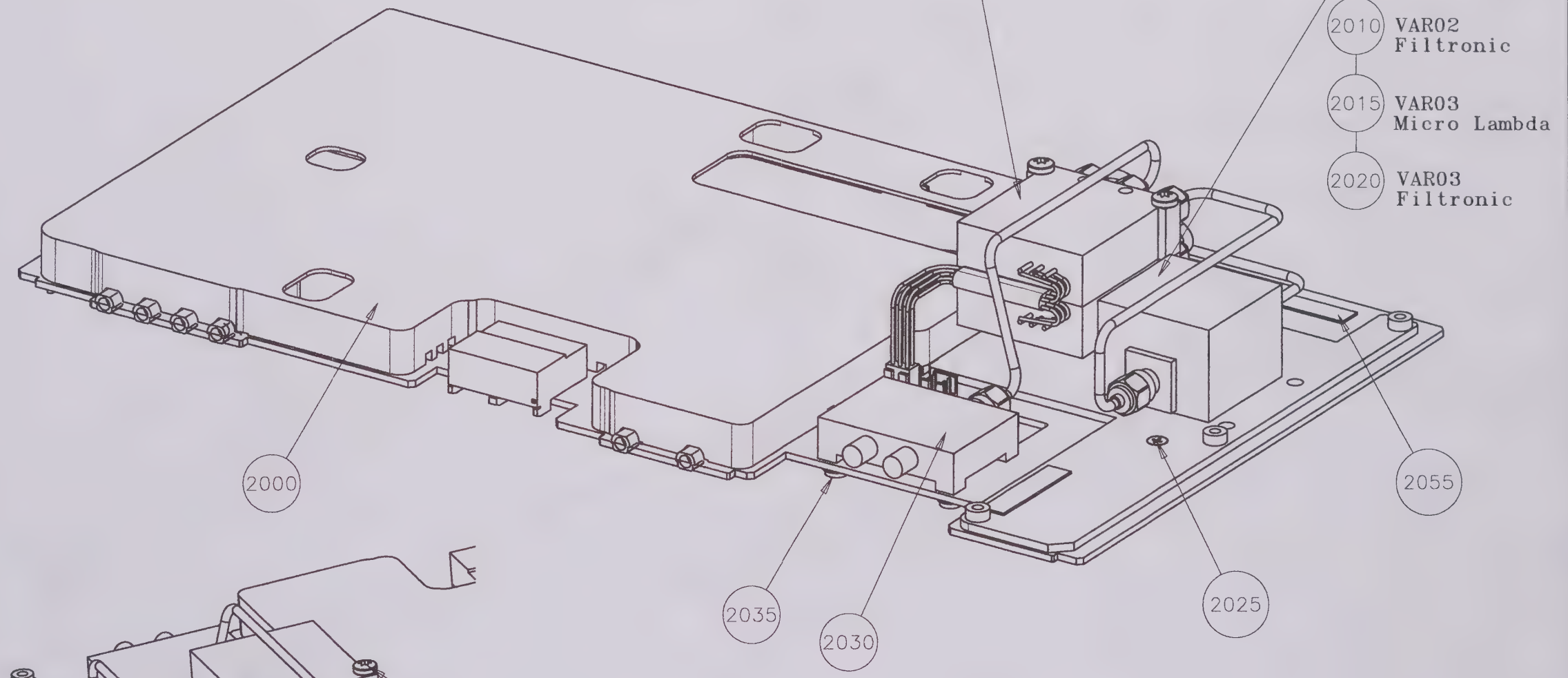

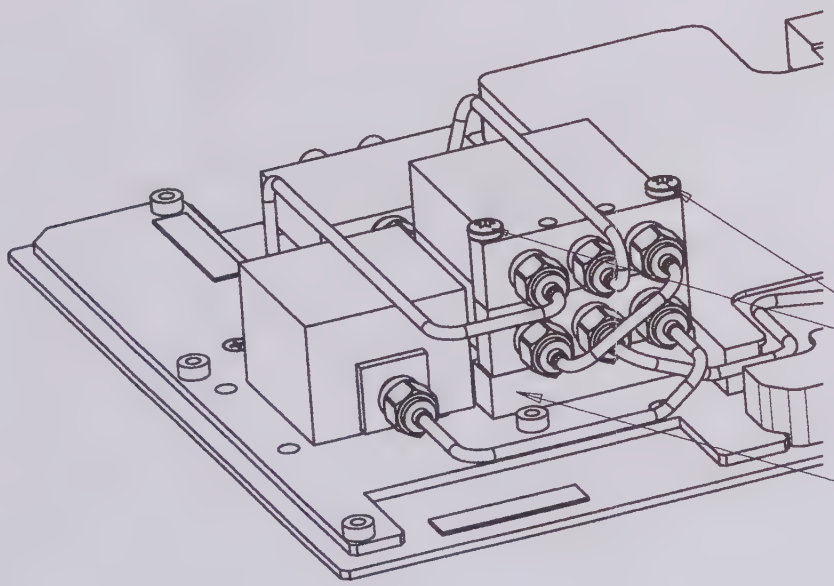

Var02 = FSP7, ESPI7, FSU8
Mod02 = FSP7, ESPI7, FSU8

Var03 = FSQ8 (mit Relais)
Mod03 = FSQ8 (with relais)

Maßstab / Scale 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: Converter Unit 8GHz			Sprache / Lang. de en	Aei. / C.I. 04.00	Blatt / Sh. 1
Typ / Type EMU				Zeichn.Nr. / Drawing No. 1130.2544.01 D	
i.Z. / used in	Datum / Date 14.05.2002	Abteilung / Dept. 1ESK	Name / Name Wn		

Projektionsmethode / Projection Method

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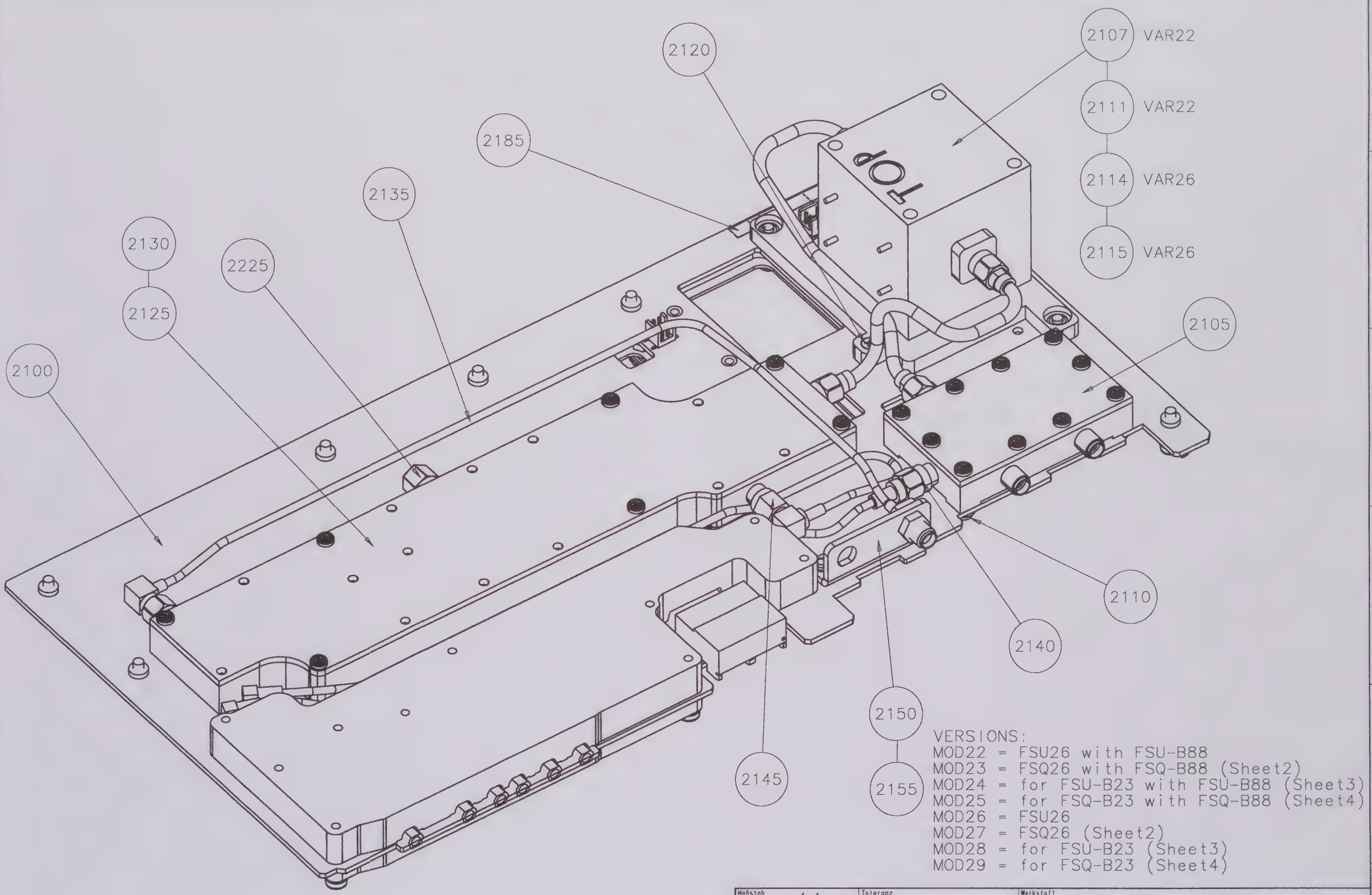

VERSIONS:
MOD22 = FSU26 with FSU-B88
MOD23 = FSQ26 with FSQ-B88 (Sheet2)
MOD24 = for FSU-B23 with FSU-B88 (Sheet3)
MOD25 = for FSQ-B23 with FSQ-B88 (Sheet4)
MOD26 = FSU26
MOD27 = FSQ26 (Sheet2)
MOD28 = for FSU-B23 (Sheet3)
MOD29 = for FSQ-B23 (Sheet4)

Maßstab / Scale 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 26 / MW-Converter Unit 26			Sprache / Lang. de en	Aet. / C.I. 05.00	Blatt / Sh. 1
Typ / Type FSU26				Zeichn.Nr. / Drawing No. 1130.3240.01 D		
i.Z. / used in 1130.9003.01	Datum / Date 06.10.2003	Abteilung / Dept. 1ESK	Name / Name Wn			

Projektions-methode
Projection Method

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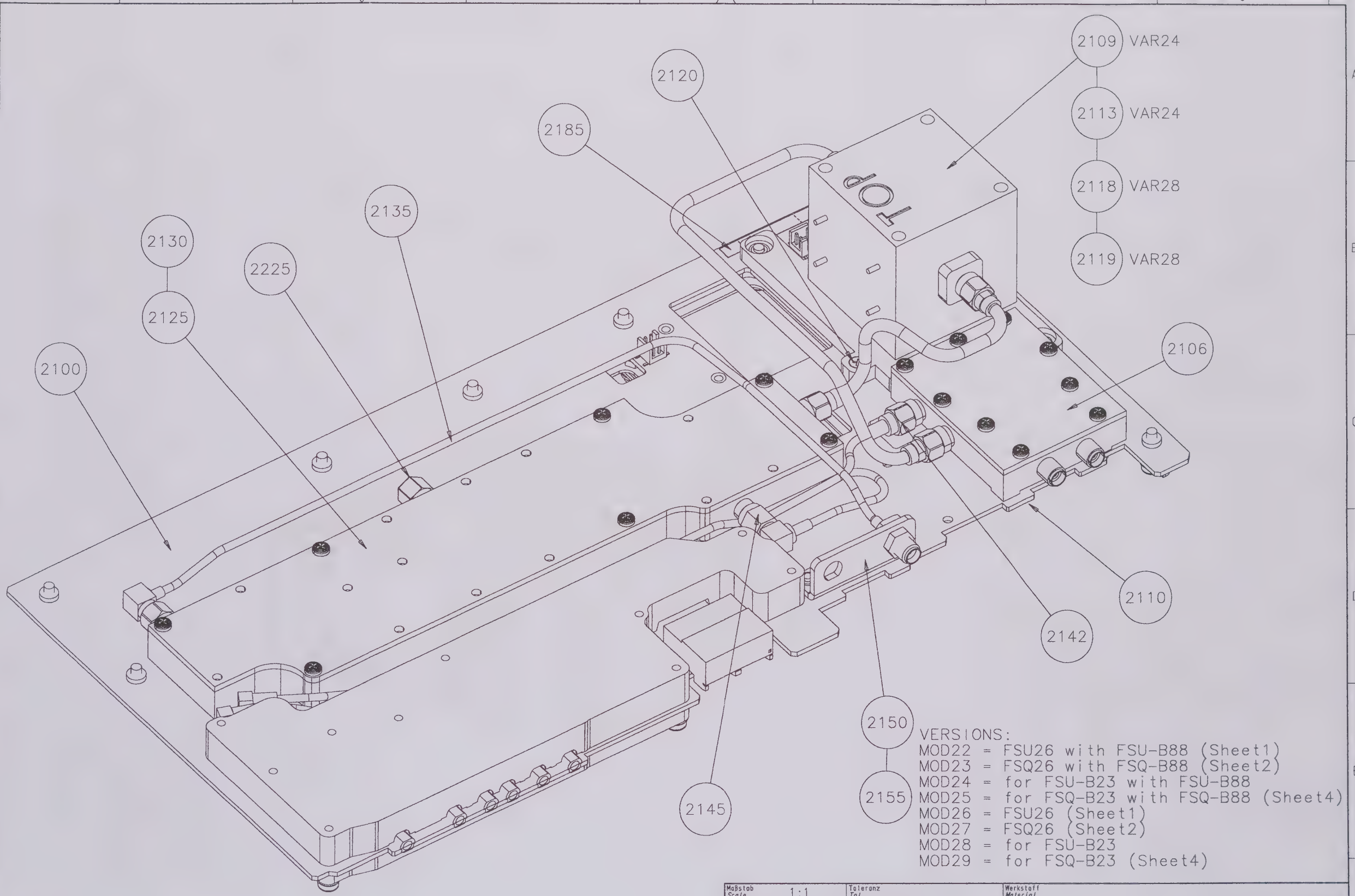

VERSIONS:
MOD22 = FSU26 with FSU-B88 (Sheet1)
MOD23 = FSQ26 with FSQ-B88 (Sheet2)
MOD24 = for FSU-B23 with FSU-B88
MOD25 = for FSQ-B23 with FSQ-B88 (Sheet4)
MOD26 = FSU26 (Sheet1)
MOD27 = FSQ26 (Sheet2)
MOD28 = for FSU-B23
MOD29 = for FSQ-B23 (Sheet4)

Maßstab / Scale 1:1	Toleranz / Tol.	Werkstoff / Material					
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 26					Sprache / Lang. de en	Aei. / C.I. 02.00	Blatt / Sh. 3
Typ / Type FSU26	MW-Converter Unit 26					Zeichn.Nr. / Drawing No. 1130.3240.01 D		
1.Z. / used in 1130.9003.01	Datum / Date 06.10.2003	Abteilung / Dept. 1ESK	Name / Name Wn				

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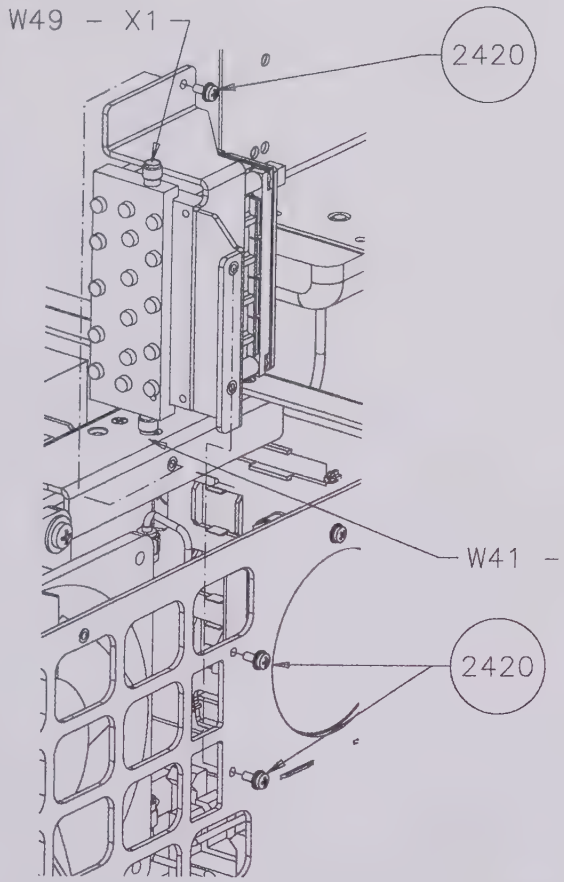
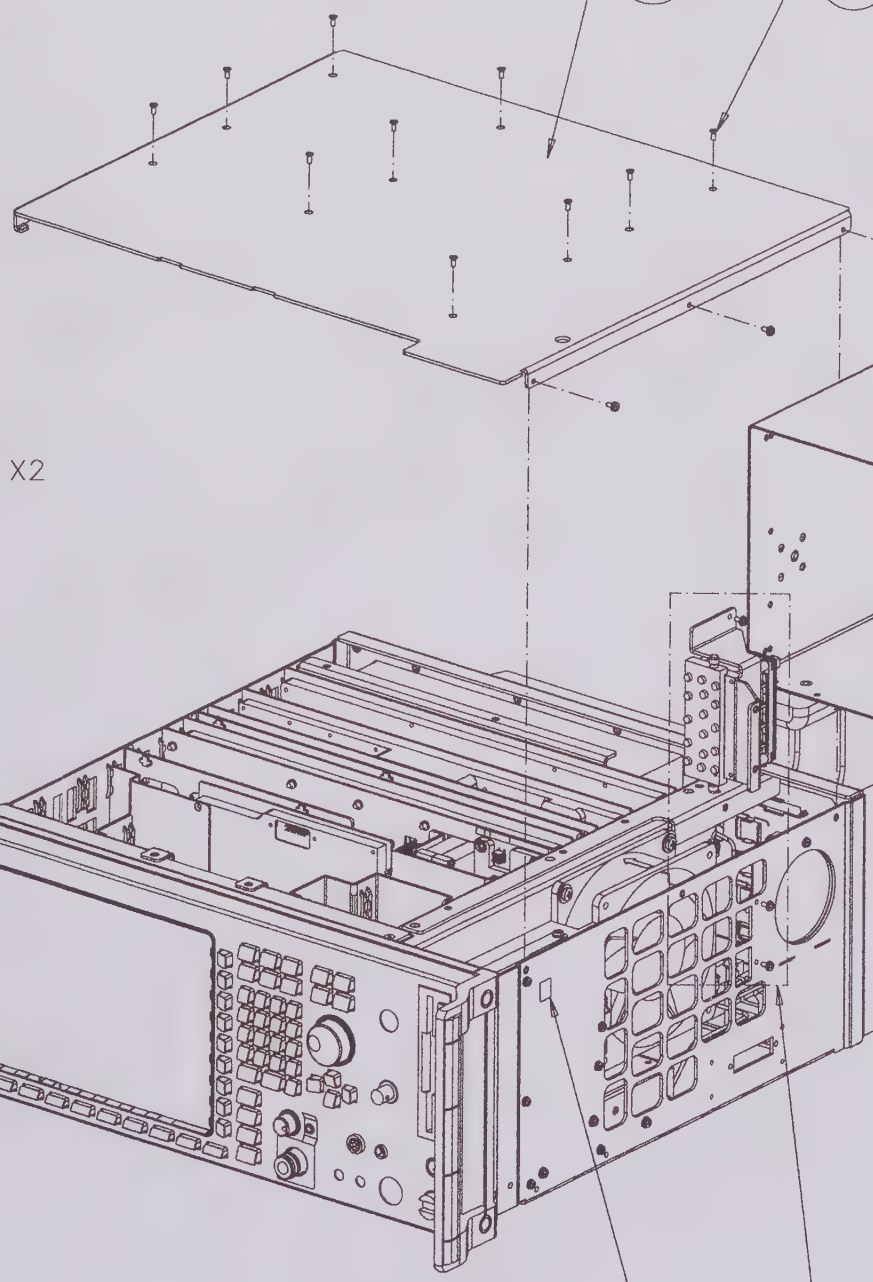
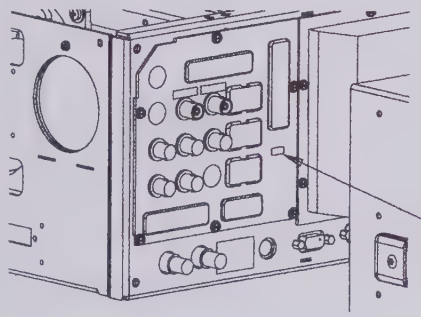


detail attenuator

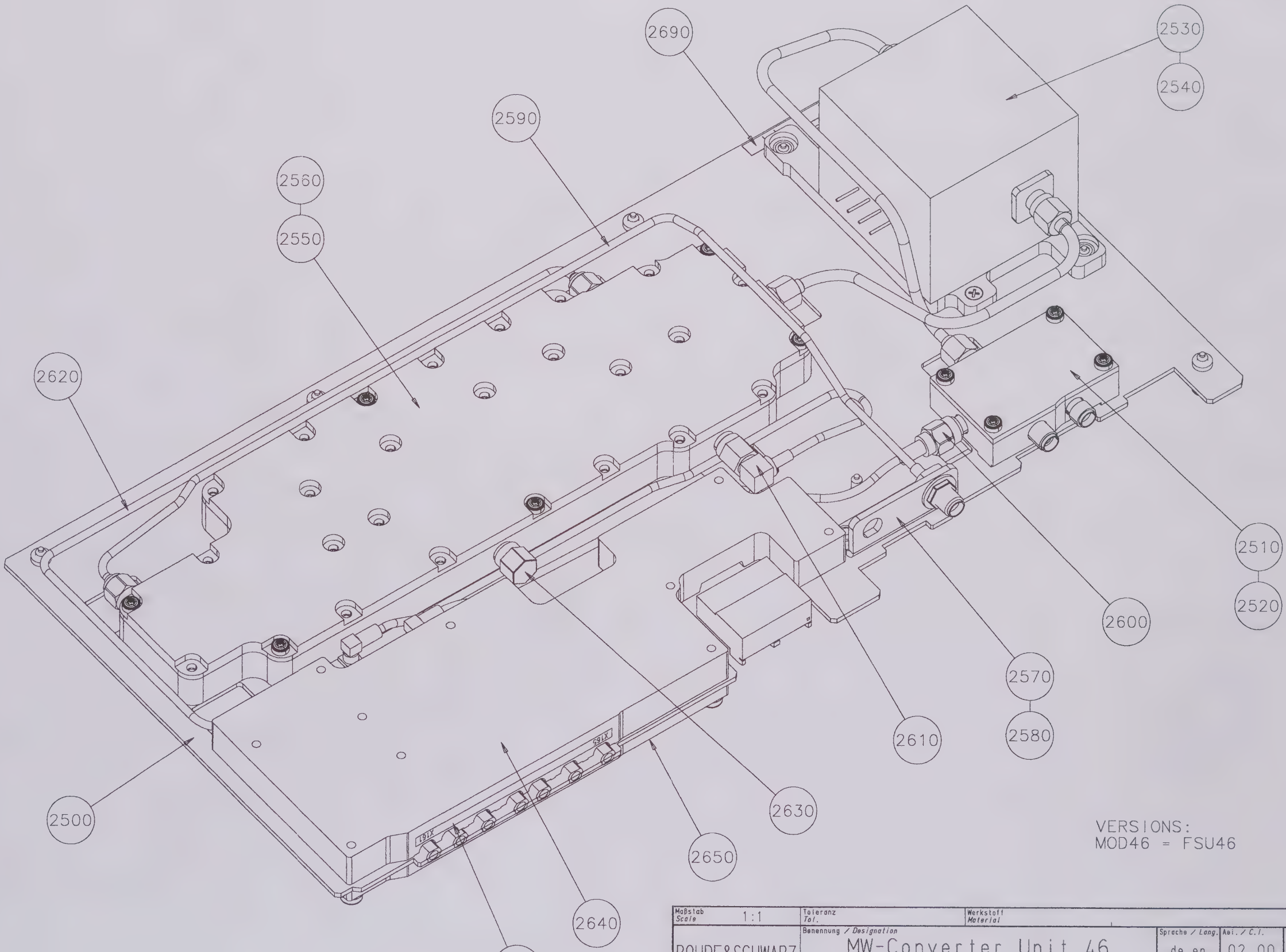


view rear panel



Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: Einbauanweisung / Assembly Instruction	Sprache / Long.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 1
Typ / Type: FSU-B12			Zeichn.Nr. / Drawing No.: 1142.9361.00 D
t.Z. / used in: 1142.9349.01	Datum / Date: 19.09.2002	Abteilung / Dept.: 1ESK	Name / Name: TF

Projektionsmethode / Projection Method



Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 46 (MW-Converter Unit 46)			Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 1
	Datum / Date: 19.02.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1130.3840.01		D

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Projektions-methode
Projection Method

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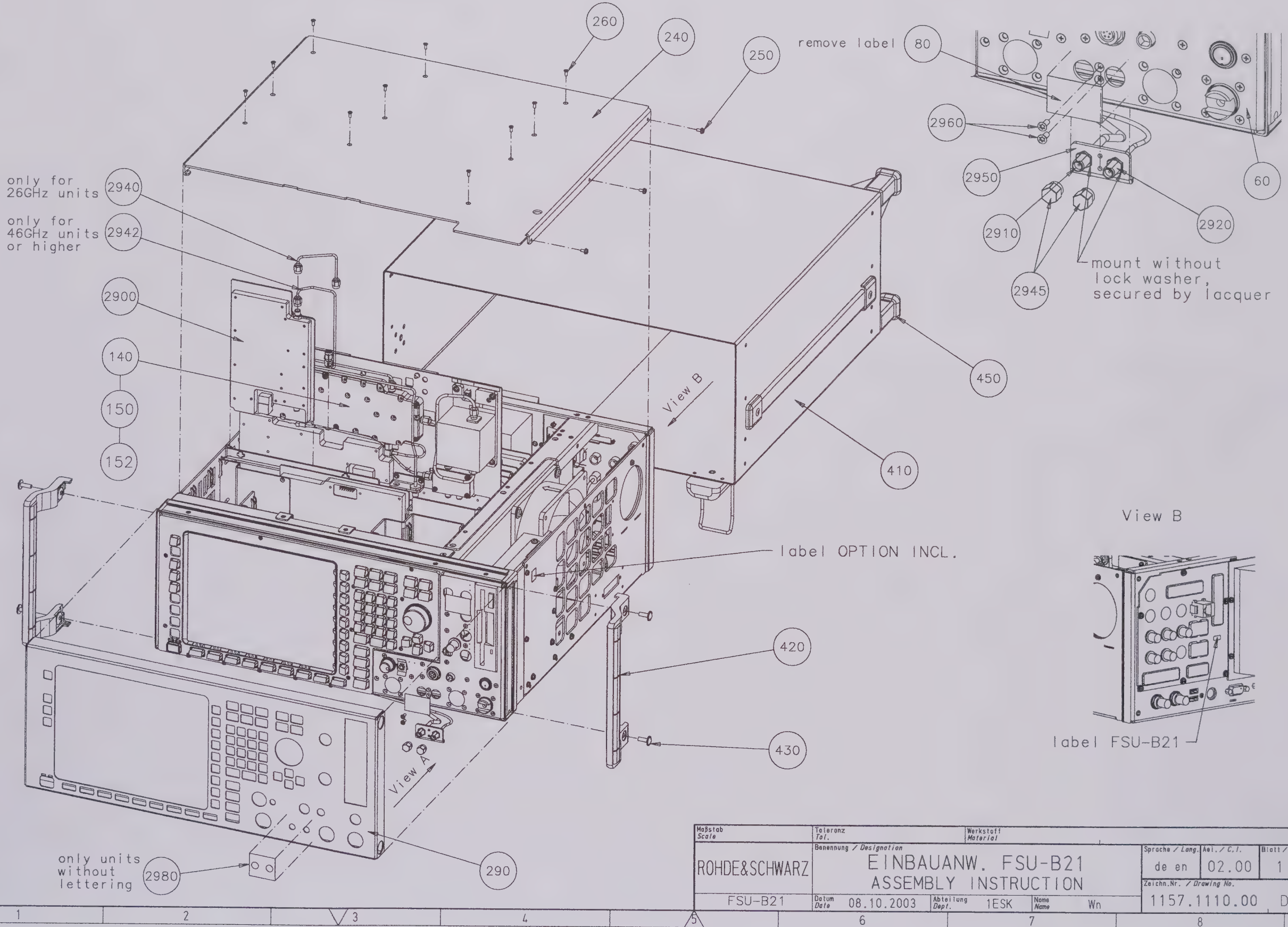

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material					
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANW. FSU-B21 ASSEMBLY INSTRUCTION				Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 1
FSU-B21	Datum / Date: 08.10.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn		Zeichn.Nr. / Drawing No.: 1157.1110.00		D

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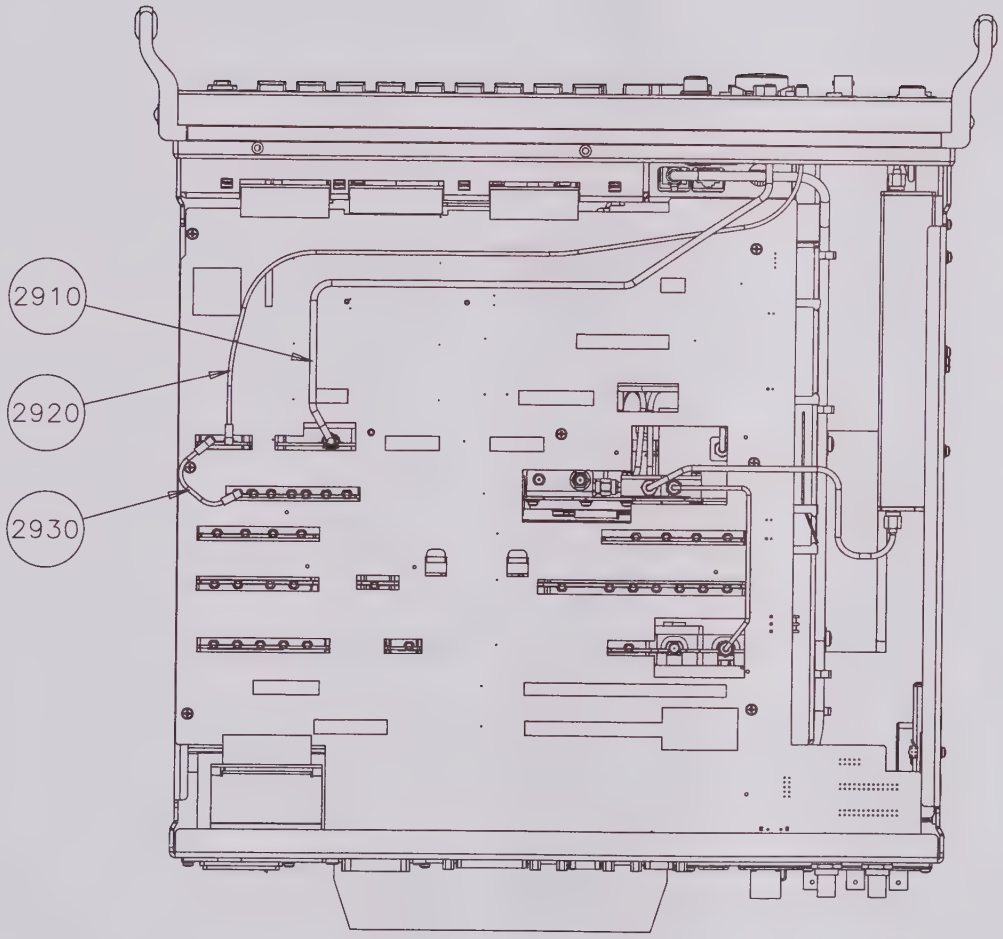
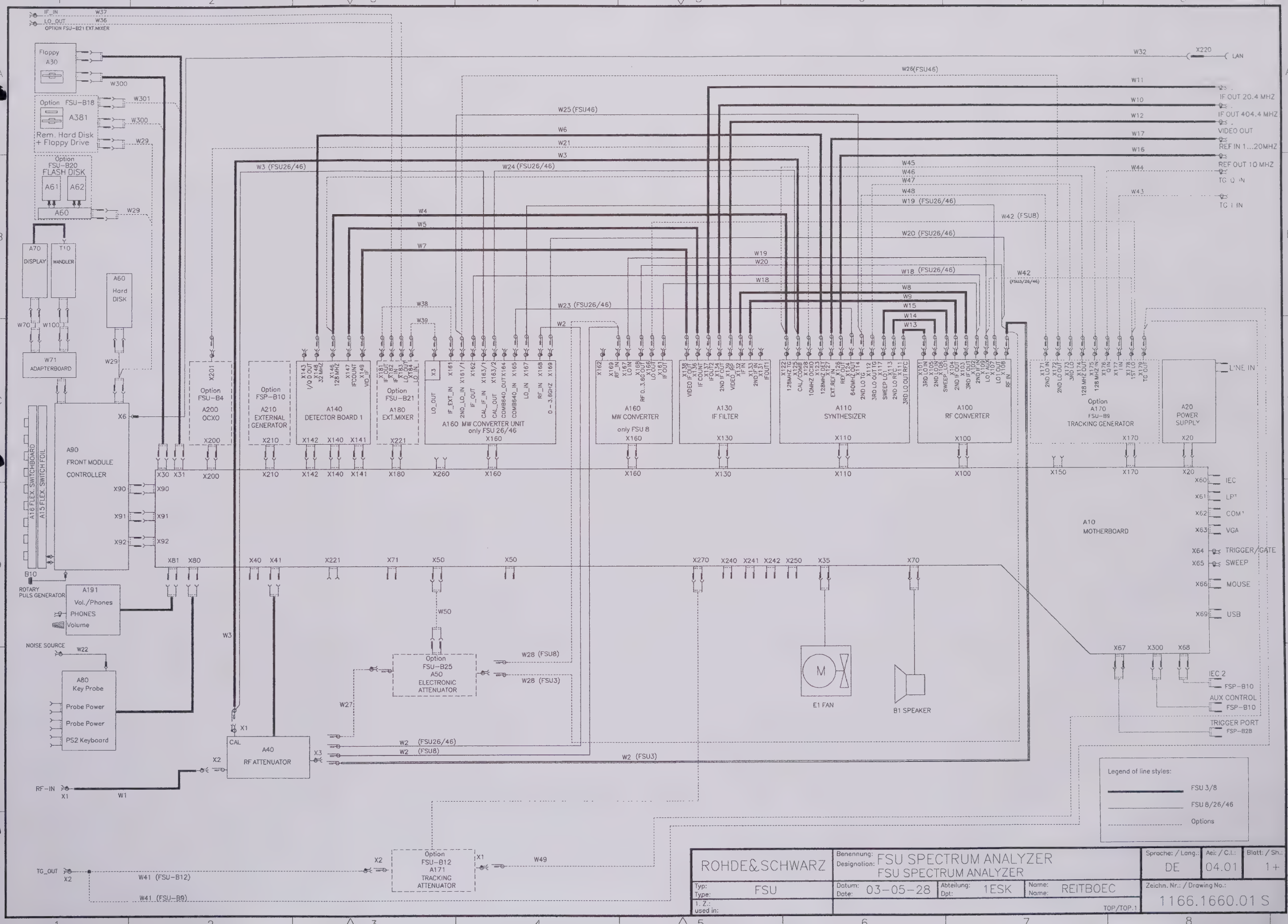


Projektions-methode
Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANW. FSU-B21 ASSEMBLY INSTRUCTION			Sprache / Lang.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 2
FSU-B21	Datum / Date: 04.06.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1157.1110.00		D

Block Circuit Diagram



ROHDE&SCHWARZ	Benennung: FSU SPECTRUM ANALYZER Designation: FSU SPECTRUM ANALYZER			Sprache: / Lang.: DE	Aei: / C.I.: 04.01	Blatt: / Sh.: 1+
Typ: FSU Type:	Datum: 03-05-28 Date:	Abteilung: 1ESK Dpt:	Name: REITBOEC Name:	Zeichn. Nr.: / Drawing No.: 1166.1660.01 S		
1. Z.: used in:	TOP/TOP.1					

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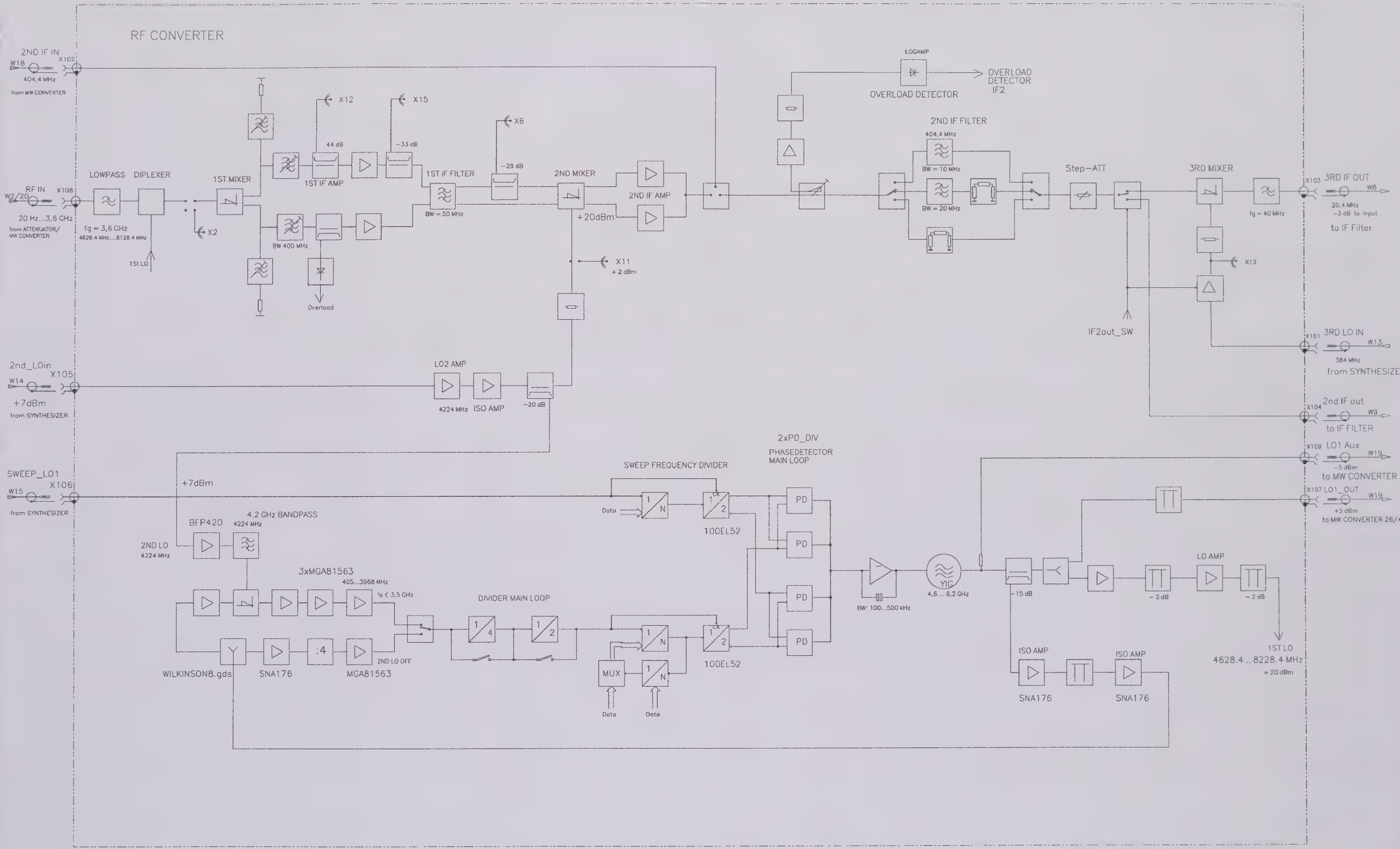
X1
RF INPUT
0 dBm
W1
RF ATTENUATOR
X2
X1
X3
0.....75 dB / 5 dB steps
W2
(W27)
OPTION B25
electronic
Attenuator
only FSU3 / FSU8
DIPLEXER
X169 FSU8 X168
X168 FSU26 X169
OPTION B25
electronic
Attenuator
only FSU26
0....3,6 GHz
−2 dBm
RF CONVERTER
X104
X108
X103
X109 X107 X102 X105 X106 X101
W19
FSU8
> 3,6 GHz
X169
MW CONVERTER
X167
1st LO
FSU26/46
4.0...7.6 GHz
−5 dBm
W18
X3
YIG
FILTER
CONVERTER
X161
X162
IF 404.4 MHz
−10 dBm
(FSU26/46)
X161 (FSU26/46)
X163/1 X163/2 X166 X161/1 X165
W9
404 MHz
+1 dBm
W8
20.4 MHz
−5 dBm
IF FILTER
Analog IF
(100 kHz...10 MHz)
X133
X132
X139 X137 X134
X138
X136
W7
RBW ≤ 100k: IF 20.4 MHz −3 dBm
RBW > 300k: VIDEO 0,42 V
W5
20,4 MHz
U_{ss} 0,4V
DETECTOR BOARD 1
X149
X147 X148 X146
PCI
FMC5
+
DISPLAY
OPTION B10
2.IEC
W10
IF OUT 404.4 MHz
W11
IF OUT 20.4 MHz
0 dBm
W12
VIDEO OUT
W3
(FSU26/46)
only FSU26/46
640 MHz
W14
W15
W13
W24
X124
X113 X117 X111
X125
SYNTHESIZER
X123
X122
X112 X114 X126 X127
W6
W4
Cal Signal
128 MHz, −30/0 dBm
W3
(FSU3/8)
Comb Signal
POWER
SUPPLY
W39
W38
2nd LO
FSU46
W25
W21
X184
LO_IN
W36
X183
LO_OUT
X181
IF OUT
W37
X182
IF IN
OPTION B21
EXT.Mix
OPTION B4
X201
OCXO
10 MHz
5 dBm
W17
REF IN
> 0dBm
W16
REF OUT 10MHz
> 3dBm
(only FSU8)
X178 1st Lo
X171 2nd LO
X173 3rd LO
X172 2nd LO Out
X175
128 MHZ
In
X174
128 MHZ
Out
Q IN
I IN
X176
X177
OPTION B9
Tracking Generator
X179
OPTION B12
Tracking Attenuator
X2
TG OUT

ROHDE&SCHWARZ	Benennung: / Designation: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER			Sprache: / Lang.: DE	Ael. / C.I. 04.01	Blatt / Sh. 2+
Typ: / Type: FSU	Datum: / Date: 03-05-28	Abteilung: / Dept: 1ESK	Name: / Name: REITBOEC	Zeichn. Nr.: / Drawing No.: 1166.1660.01 S		
1. Z.: / used in:	TOP/TOP.2					



ROHDE&SCHWARZ	Benennung: FSU SPECTRUM ANALYZER Designation: FSU SPECTRUM ANALYZER				Sprache: / Lang.: DE	Aen. / Cl.: 04.01	Blatt. / Sh.: 3+
Typ: FSU Type:	Datum. 03-05-28 Date:	Abteilung: 1ESK Dpt:	Name: REITBOEC Name:	TOP/TOP.3	Zeichn. Nr.. / Drawing No.: 1166.1660.01 S		
1. Z.: used in:							

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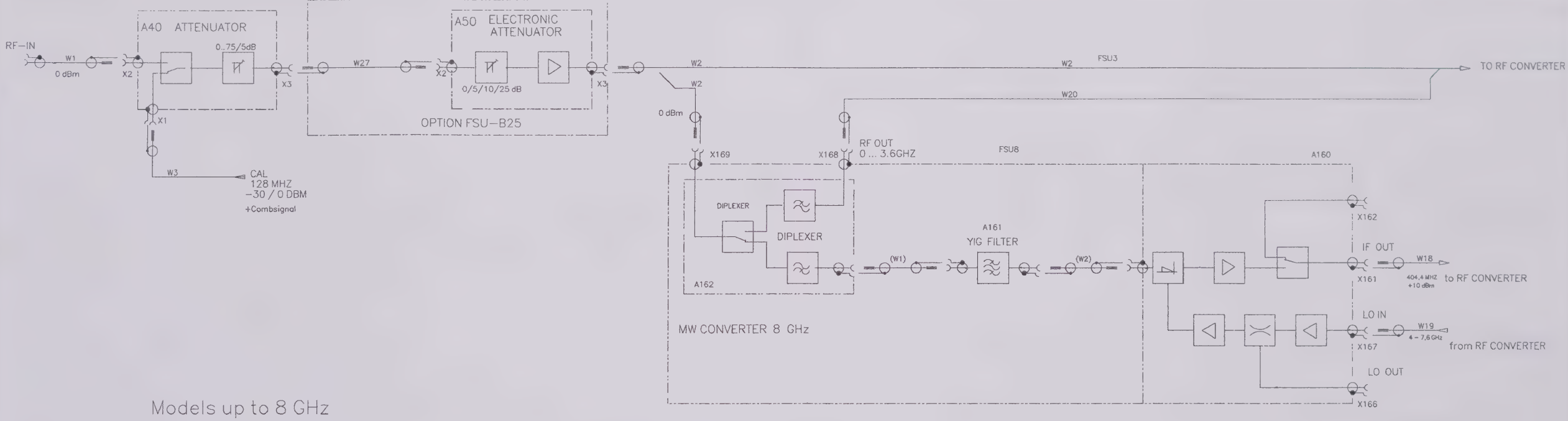
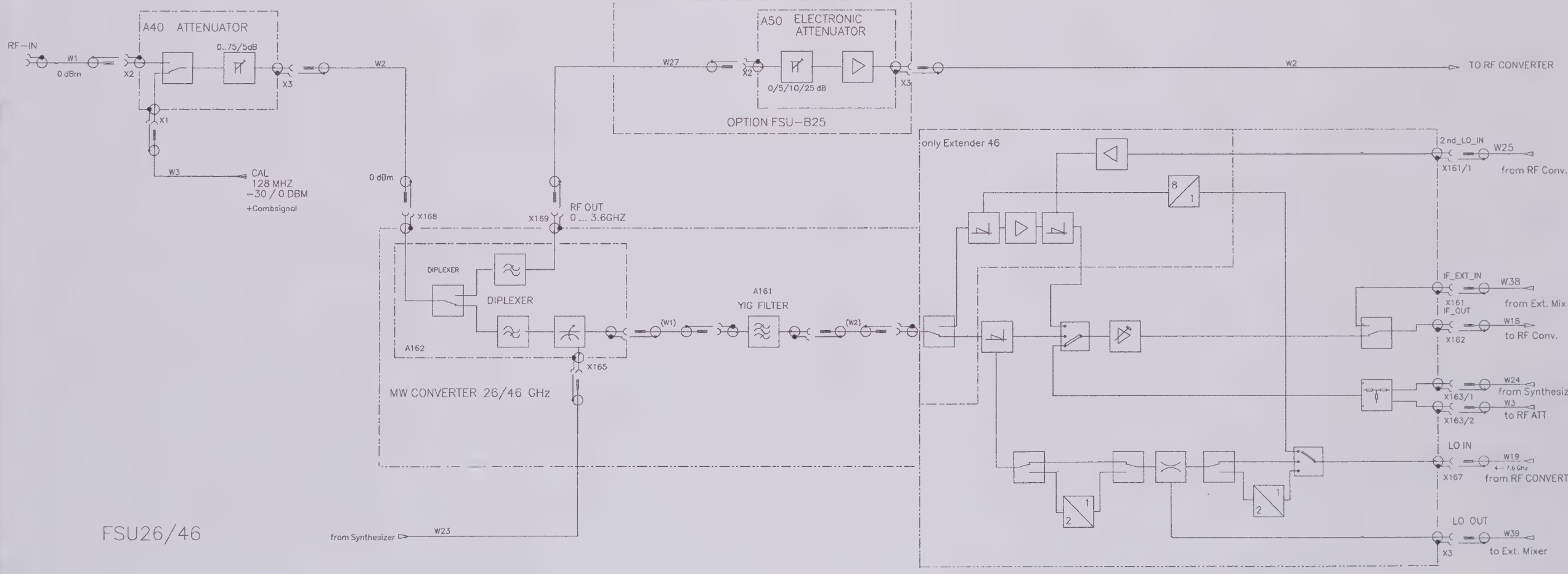


Models up to 8 GHz



FSU26/46

ROHDE&SCHWARZ	Benennung: / Designation: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER				Sprache: / Lang.: DE	Aei: / C.I.: 04.01	Blatt / Sh.: 4+
Typ: / Type: FSU	Datum: / Date: 03–05–28	Abteilung: / Dpt: 1ESK	Name: / Name: REITBOEC		Zeichn. Nr.: / Drawing No.: 1166.1660.01 S		
1 Z: / used in:	TOP/TOP.4						

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IF FILTER

X131 IF OUT1 0 DBM

FILTER FFT CAL FFT

XTAL CAL XTAL XTAL CAL XTAL

FILTER 0 CAL LC

Level Offset

CALAMP 1 −3...+3 DB

20.4 MHz IF IN W8 X132 from RF CONVERTER

SELFTEST/ RF OVERLOAD DETECTOR

STEP GAIN 0 ... 6 DB

CALAMP2

0/10 dB

Freq. Resp.

RBW 200 KHz...3 MHz

FILTER1 CAL LC FILTER2 CAL LC

RBW 10 MHz Path

SELFTEST/ IF OVERLOAD DETECTOR

STEP GAIN −20...+40 DB

STEP FINE 0...12 dB

STEP COARSE −20/−10/0/10/20/30/dB

SELFTEST/ IF OVERLOAD DETECTOR

RBW 200 kHz... 3MHz

FILTER3 CAL LC FILTER4 CAL LC

RBW 10 MHz Path

X137 IF OUT2 0 DBM W11 to REAR PANEL

20.4 MHz NOISE FILTER LOGAMP IF 20.4 MHz

RBW > 200 kHz

X136 IF_COUNT W5 to DETECTOR BOARD

Video

VIDEO OFFSET D/A

10 MHZ

RBW ≤ 100 kHz

11.6 MHZ

LINEAR DETECTOR

only for Calibration

SELFTEST

RBW < 200 kHz: IF 20,4 MHz, − 1 dBm
RBW >= 200 kHz: Video, 0..336V

X138 VIDEO/IF OUT W7 to DETECTOR BOARD

X139 VIDEO_RP W12 to REAR PANEL

1 MHZ

DITHER GENERATOR F0 = 500 KHZ

AWB. CALAMP 1 −3...+3 DB

AWB. CALAMP 2 −0...+6 DB

NOISE FILTER LOGAMP

2 nd IF IN W9 X133 from RF CONVERTER

2 nd IFOUT W10 X134 to REAR PANEL

WB. STEPGAIN −3...+20 DB/1DB

AUDIO IN

Demodulator / Audio

QUASIPEAK

TO SPEAKER/PHONES

AM/FM−DEMOD. AM FM

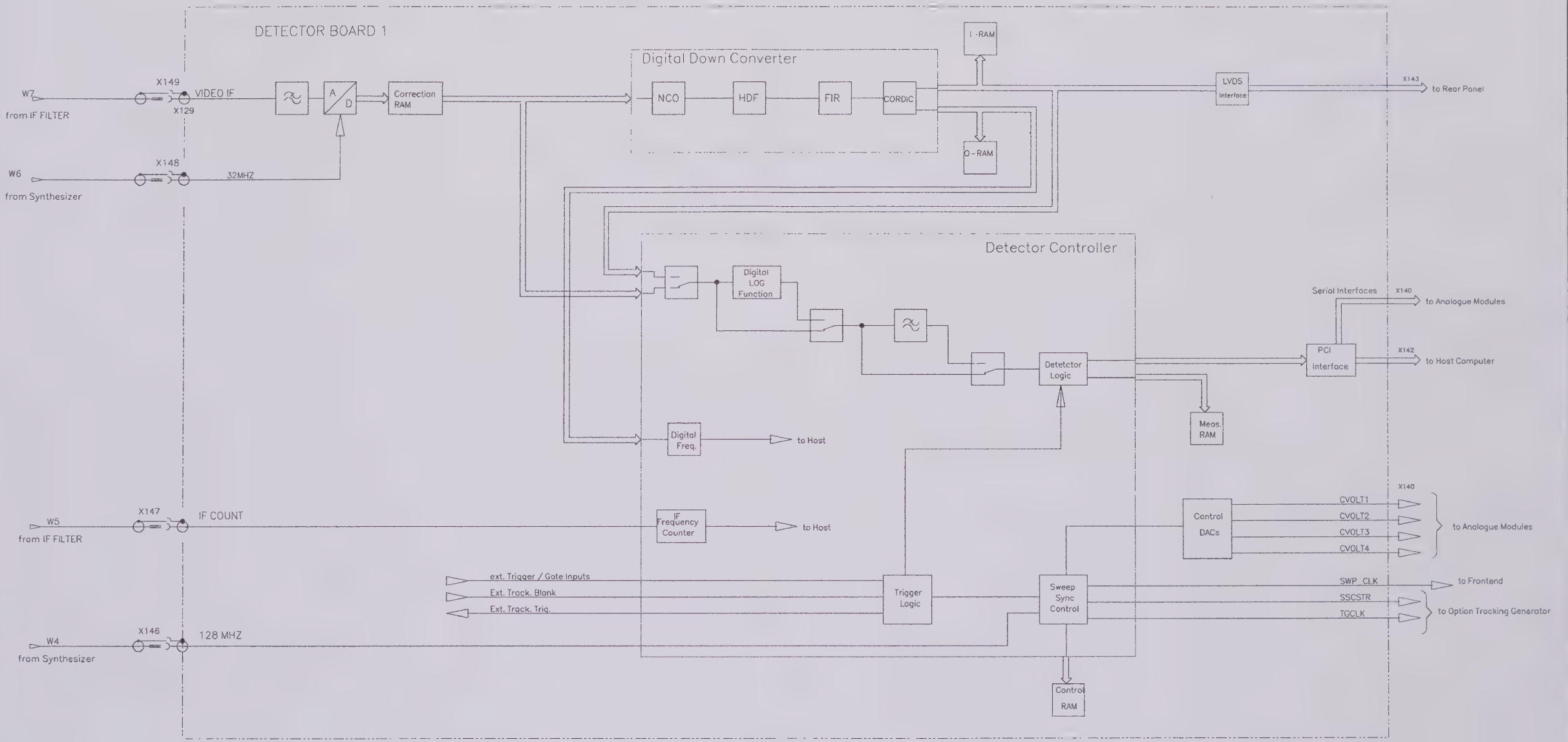
0...40 dB

COUNTER PR U D

D/A

from Knob VOLUME

ROHDE&SCHWARZ	Benennung: FSU SPECTRUM ANALYZER Designation: FSU SPECTRUM ANALYZER			Sprache: / Lang.: DE	Aei: / C.I.: 04.01	Blatt: / Sh.: 5+
Typ: FSU Type:	Datum: 03−05−28 Date:	Abteilung 1ESK Opt.	Name: REITBOEC Name:	Zeichn. Nr.: / Drawing No.: 1166.1660.01 S		
1 Z used in:	TOP/TOP.5					



ROHDE&SCHWARZ	Benennung: / Designation: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER					Sprache: / Lang.: DE	Aei: / C.I.: 04.01	Blatt. / Sh.: 6+
Typ: / Type: FSU	Datum: / Date: 03-05-28	Abteilung: / Dpt: 1ESK	Name: / Name: REITBOEC			Zeichn. Nr.: / Drawing No.: 1166.1660.01 S		
1. Z.: / used in:	TOP/TOP.6							

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SYNTHESIZER

OPTION B4
OCXO

ext. REF in
W17
X127
1..20MHz
+0 dBm...+10 dBm
from REAR PANEL

W21
X128
10 MHz
+3 dBm...+10 dBm
from OCXO OPT

OCXO 10MHz

12BMHz

Finecomb
10 KHz
100 KHZ
1 MHz

CalGen
128MHz
0dBm / −30 dBm

MULT

COMB 128

640 MHz

384 MHz

CombGen
640 MHz

384 MHZ
G

SYNCON

Sweep LO1
W15
X117
595..620MHz / +6 dBm
45..20MHz / + 2 dBm
to RF CONVERTER

595..620 MHz
G

N
1

f offset

DRO
G

4224 MHz

4224 MHz offset

1..4
1

Ref out 1..20MHz
W16 to REAR PANEL
X126 +4dBm... +11dBm

W4 to DETECTOR BOARD 1
X122 128MHz −0 dBm

W6 to DETECTOR BOARD 1
X123 128MHz 0 dBm
32MHz −1dBm

W3 to RF ATTENUATOR
X125 CAL out 128MHz/0dBm/−30dBm
COMB out

640 MHz
W23 to MW Converter (FSU26)
X124 640MHz out
+13dBm

384MHz
W13 to RF CONVERTER
X111 3rd LO out +11dBm

X112 3rd LO out +11dBm

W14 to RF CONVERTER
X113 2nd LO out +8 dBm

W25 to MW CONVERTER 46
X114 2nd LO out +4 dBm

OR
W48 to Tracking Generator
2nd LO out +4 dBm

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ROHDE&SCHWARZ	Benennung: / Designation: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER				Sprache: / Lang.: DE	Aen. / Ch. 04.01	Blatt / Sh. 7 F
Typ: / Type: FSU	Datum: / Date: 03-05-28	Abteilung: / Dpt: 1ESK	Name: / Name: REITBOEC		Zeichn. Nr.: / Drawing No.: 1166.1660.01 S		
1. Z.: / used in.	TOP/TOP.7						

OPTION FSU –B9
Tracking Generator

W47 X173 384 MHz from SYNTHESIZER

W45 X175 128 MHz In from SYNTHESIZER

W46 X174 128 MHz Out to Detector Board

MVCO

MIX3

404,4 MHz

IQ + AM
IQ–MOD

MIX2

4628,4 MHz

MIX1

3600 MHz

FM
D/A

RF OUT X179
100 kHz ... 3.6 GHz

W49

OPTION FSU –B12
Tracking Attenuator
X2
40 dB
20 dB
10 dB
X1

W41
to Front Panel – X2

W41

W44 X176 Q IN from Rear Panel

W43 X177 I IN from Rear Panel

W48 X171 4224 MHz In from SYNTHESIZER

X172 4224 MHz Out

W47 X178 4.6 . . 8.2 GHz from SYNTHESIZER

OPTION B21
Ext. Mixer

W39 MWC–40 X184 LO_IN

LO_ON

V_AMP

BUS
D/A

X183 LO_OUT

W36 to Front Panel

W38 MWC–40 X181 IF_OUT

LO_ON

X182 IF IN

W37 to Front Panel

SW IF

ROHDE&SCHWARZ	Benennung: / Designation: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER			Sprache: / Lang.: DE	Aei: / C.I.: 04.01	Blatt / Sh.: 8–
Typ: / Type: FSU	Datum: / Date: 03–05–28	Abteilung: / Dpt: 1ESK	Name: / Name: REITBOEC	Zeichn. Nr.: / Drawing No.: 1166.1660.01 S		
1 Z: / used in:	TOP/TOP.8					